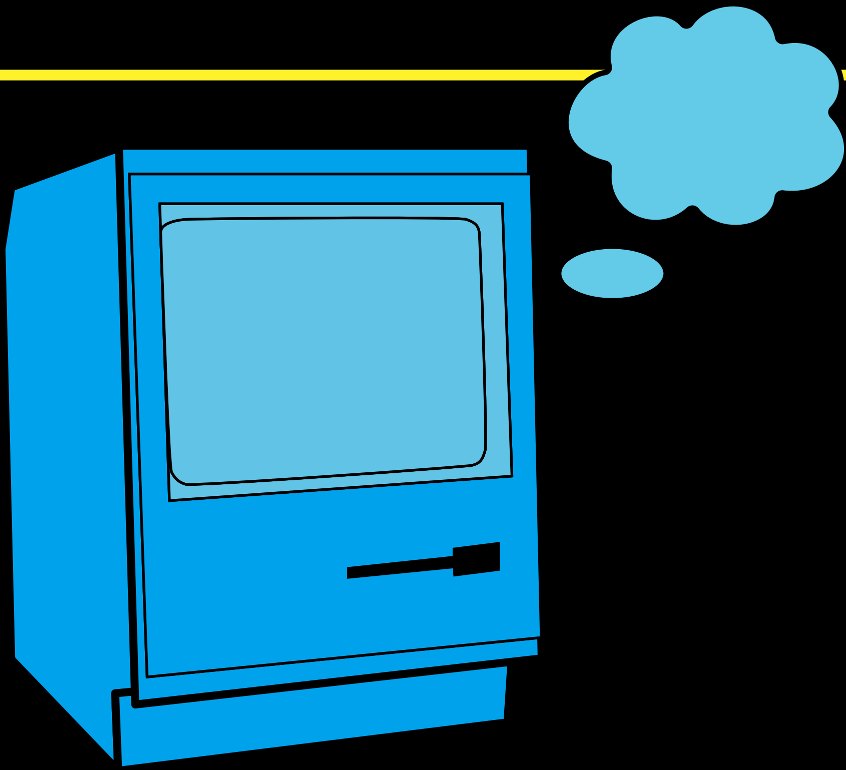

ELECTRIC DREAMS

30th ascilite Conference, 1-4 December 2013
Macquarie University, Sydney

PROCEEDINGS

Proceedings Editors: H. Carter, M. Gosper & J. Hedberg

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MACQUARIE UNIVERSITY

ascilite
Australasian Society for Computers in Learning in Tertiary Education

TABLE OF CONTENTS

The ascilite 2013 Conference Program Committee confirms that full and concise papers accepted for this publication:

- Meet the definition of research in relation to creativity, originality, and increasing humanity's stock of knowledge;
- Are selected on the basis of a peer review process that is independent, qualified expert review; double-blind reviews conducted on the full articles, prior to publication;
- Are published and presented at a conference having national and international significance as evidenced by registrations and participation; and
- Are made available widely through the Conference web site.

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ascilite 2013 Conference Program Committee

Helen Carter	Conference Co-Convener
John Hedberg	Conference Co-Convener
Maree Gosper	Paper Review Coordinator

ascilite 2013 Conference Program Committee editorial

compiled by Helen Carter

This is a report on the submissions, review and selection of papers, symposia, workshops and posters for the ascilite 2013 conference held at Macquarie University, 1-4 December 2013. The following data provides a breakdown of the numbers of papers accepted for the conference along with demographic information and compares these figures with previous conferences. All data provided is at the 18 November 2013 and may be subject to late changes due to cancellations.

Table 1. Breakdown of all submissions

Submission Type	Submitted	Accepted	Rejected	Withdrawn after acceptance
Full	64	47	17	
Concise	123	94	29	11
Poster	28	26	2	2
Symposium	12	8	4	
Workshops	19	13	6	
TOTALS	**244**	**188**	**58**	**13**

Paper Submissions and Themes

Consistent with sector-wide trends, the number of full papers submitted this year has declined (2012: 75). This decline however has been offset by an increase in the number of concise papers (2012: 77). More papers have been rejected this year than in previous years, with up to 1 in 4 papers falling short of the required standard. Nonetheless, the total paper count is similar to the 2012 count (141). Fewer full papers and some rescheduling (e.g. hosting the posters out of session) have enabled the program to fit into six parallel streams over three days (2012 & 2011: seven streams). There is a good diversity of paper themes across the accepted full and concise papers, with not unexpectedly both learning design and e-Learning most favoured.

Table 2. Paper Themes of accepted papers

#	Theme	Full Papers	Concise Papers	Total
1	e-Learning	15	31	46
2	Learning Design	7	21	28
3	Assessment	7	8	15
4	Professional Learning	5	7	12
5	Literacies (TPACK)	4 (1)	7 (1)	11
6	Virtual Worlds	4	7	11
7	Mobile Learning	4	5	9
8	MOOCs/Open Education	1	6	7
9	Learning Analytics [1]	-	2	2
	TOTALS	**47**	**94**	**141**

[1] although only 2 papers are themed on Learning Analytics, this was likely due to the SOLAR A-LASI mini-conference (see Table 4) in the workshop program on the Sunday before the conference with 11 presentations.

All full and short papers were double-blind peer reviewed and in the case of all conditionally accepted papers, went through a third review process. In summary, 64 full papers were submitted with 14 accepted without change and 32 conditionally accepted (see Table 1). Similarly, of the 123 concise papers submitted (see Table 1), 26 were accepted without change and 67 were conditionally accepted. Conditionally accepted papers required that author(s) revise the work based on feedback provided from the reviewers. An additional full paper and concise paper submission were invited to present but are included in this publication as non-refereed papers. These were both due to paper withdrawals and to these submissions being of interest to the conference.

Digital Poster Submissions

This year introduction of the digital poster at the ascilite 2013 conference, taking advantage of a new active learning space at Macquarie University and promoting a high degree of interactivity. Digital posters will also be made available online. Poster submissions remained at similar levels to the ascilite 2012 (29) conference.

Table 3. Poster Themes based on accepted digital posters

#	Theme	Count
1	Spaces, policies and planning for the future	8
2	Professional development and community	8
3	Student learning, experiences and expectations	8
	TOTAL	**24**

Conference Workshops

Sunday workshop attendance required the registrant to pay an additional fee on top of the conference registration. One of the keynotes chose to offer a shortened workshop on the Sunday before the conference. 3 workshops were run in conference streams and required no additional fee. 2 of these were connected with sponsorship deals.

Table 4. Detail of workshops on offer for the ascilite 2013 conference

Duration	Fee[2]	Title
Full Day	Y	Australian Learning Analytics Summer Institute (A-LASI)
Full Day	Y	Media for Academic Purposes
Full Day	Y	Augmenting Mobile Movie Production
Half Day	Y	Creating Active Learning Environments – The Flipped Classroom
Half Day	Y	Standards for Online Education
Half Day	Y	Sunset: a tool for condensed summer term blended learning design
Half Day	Y	Planning research into contemporary learning environments
Half Day	Y	Moving from "e" to "d": what does a digital university look like?
Half Day	Y	Open education practices: the good, the bad and the ugly.
Special	Y	Building the Future-Proof Classroom: keynote workshop
Special	N	Blended Synchronous Learning: Uniting On-Campus and Distributed Learners Using Rich-Media Real-Time Collaboration Tools
Special	N	Epigeum: sponsor workshop
Special	N	Desire2Learn: sponsor workshop

[2] at point of publication it is not known which workshops will be run, as it relies on adequate registrations

Comparison with previous conferences

Over the last ten years the total number of submissions has steadily grown, although as mentioned previously, the number of full paper submissions has decreased, this has been compensated by increased concise paper submissions." to "Over the last ten years the total number of submissions has steadily grown. Although, as mentioned previously, the number of full paper submissions has decreased, this has been compensated by increased concise paper submissionsThe number of poster presentations and symposia remains steady. Symposia seems now to be an expected component of a successful conference program.

Table 5. Number of submissions and presentations at ascilite conferences from 2002 – 2013

	Pert 04	Bris 05	Sydn 06	Sing 07	Melb 08	Auck 09	Sydn 10	Hoba 11	Well 12	Sydn 13
Total received submissions	153	119	194	195	216	226	207	214	201	244
Total presentations	131	96	152	166	162	180	155	165	182	188 (13)[3]
Full paper submissions	104	82	108	109	113	104	82	88	75	62
Concise paper submissions	44	29	72	63	86	87	71	79	77	123
Full paper presentations	68	56	69	80	76	72	57	66	61	47
Concise paper presentations	51	30	53	46	59	69	62	78	77	94 (11)[4]
Poster presentations	12	10	30	40	27	39	36	21	30	24
Symposium presentations	n/a	n/a	n/a	n/a	n/a	n/a	5	11	10	8
Workshop presentations	n/a	n/a	n/a	n/a	n/a	n/a	15	6	5	13[5]

The number of accepted papers continues to be dominated by those from Australia and New Zealand, with the United Kingdom consistently the next largest contributor. Significant global financial issues in Europe would however contribute to fewer submissions, therefore fewer acceptances. The Society should consider better marketing its conference to other regions but particularly to Asia.

Table 6. Accepted full and concise papers by country

Country	Full	Concise	Total	% Total
Australia	35	69	104	73.8
New Zealand	6	17	23	16.3
United Kingdom	3	2	5	3.6
Malaysia	1	1	2	1.4
Denmark	-	2	2	1.4
United States	1	-	1	0.7
Slovenia	1	-	1	0.7
Canada	-	1	1	0.7
Finland	-	1	1	0.7
Malta	-	1	1	0.7
	47	**94**	**141**	**100.0**

A total of 130 reviewers contributed their time to review the 244 submissions received for the conference. Maree Gosper from Macquarie University coordinated the distribution of full and concise papers for review, which was largely a manual process due to the Society not having its own paper management system, something to be addressed for future ascilite conferences.

[3] includes A-LASI mini-conference (see table 4)
[4] papers withdrawn after acceptance due to varied reasons, often through lack of financial support

ascilite 2013 Conference Reviewers

First Name	Last Name	Affiliation
Shirley	Agostinho	University of Wollongong
Peter	Albion	University of Southern Queensland
Belinda	Allen	University of Southern Queensland
Alan	Anderson	University of Newcastle
Trish	Andrews	The University of Queensland
Roger	Atkinson	Retired
Sandy	Barker	University of South Australia
Carolyn	Beasley	Swinburne University of Technology, Melbourne
Robyn	Benson	Monash University
Marsha	Berry	RMIT University, Melbourne Australia
Philip	Betts	Macquarie University
Shaista	Bibi	The University of Sydney
Trevor	Billany	Charles Darwin University
Ruth	Billany	Charles Darwin University
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Thomas	Cochrane	Auckland University of Technology
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Mark	Freeman	The University of Sydney
Jamie	Gabriel	Macquarie University
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Lisa	Wise	Swinburne University of Technology, Melbourne
Huay Lit	Woo	Nanyang Technological University, Singapore

Tay Lee	Yong	Beacon Primary School, Singapore

ascilite 2013 Paper Contents

ELECTRIC DREAMS
30th ascilite Conference, 1-4 December 2013
Macquarie University, Sydney

Identifying e-learning principles for Maritime Education through the e-initiatives project: A design-based approach

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The Australian Maritime College (AMC) has a major objective to innovate and build better practice in e-learning by developing high quality learning for anyone, anytime, anywhere. One strategy that the AMC has undertaken to achieve this is to fund a number of e-initiatives (learning and teaching projects being undertaken using digital technologies) each year between 2012 and 2016. To gain maximum long-term benefit from this project it is essential to develop an evidence based approach, studying each initiative's effectiveness and derive learning and teaching (L&T) principles for using technology within the maritime context. This paper describes a project to explore, implement and document e-learning principles relevant to the maritime education context. The project uses an educational design-based approach. At conclusion of the project it is expected that a number of learning designs and guiding principles for maritime education will be developed.

Keywords: e-learning, Maritime Education, design-based research, learning designs

Introduction

> ... the capacity for technology to enhance the student experience … is enormous. This presents exciting opportunities to refresh curricula approaches and the challenges of ensuring staff are aware of these opportunities (UTAS, 2012).

The Australian Maritime College (http://www.amc.edu.au/) is committed to expanding the use of technology that enhances learning and teaching. Part of its strategic planning is to strengthen e-learning and assessment through a structured program which includes the provision of funding for a number of grass roots e-learning initiatives (AMC Strategic Plan, 2012-2014). These e-initiatives are seen as a way to build better practice in e-learning and potentially provide new and exciting opportunities for expansion of learning and teaching into flexible learning environments in the maritime context. According to the AMC executive management team (AMC, 2012) a number of environmental drivers have precipitated the need for greater awareness and practice in e-learning, including:

- Changes in teaching and learning theory and practice, with an increased focus on student-centred learning and a subsequent change in the role of the teacher from lecturer, or sage on the stage (King, 1993), to a facilitator of learning in partnership with students;
- Opportunities to participate in emerging markets in the broader maritime sector and non-maritime sectors;

- Rapid technological change and development with a growing need for seafarers with advanced technological skills.

The challenge for teachers within the AMC and indeed in maritime education is to deliver quality learning and teaching within an environment that may be unfamiliar to them and many of their clientele. The industry has typically used a hands-on training approach, which provides skills, context, experience, a physical environment, and tactile feedback. The predominant face-to-face approach to learning and teaching within maritime training is understandable, given the nature of traditional workplace practice. One of the greatest limitations of providing e-learning in the maritime industry where participants are from all parts of the globe is delivering it in a form that maybe very effective for those whose first language is English, but may be less than effective for those with other linguistic backgrounds. Another limitation is to provide access to resources that are easy to access ashore, but providing access to seafarers at sea with limited bandwidth, and speed possess a major hurdle.

Guiding principles underpinning research

The e-initiative project is being guided by two major theoretical frameworks or guiding principles: learning designs and learning themes.

The first learning framework underpinning the research is learning design theory. Learning designs are visual diagrams or templates of student learning experiences. Oliver and Herrington (2001) suggest that a learning design is a framework that "provides structure to support the design process" (p. 17). A learning design should include the following elements: learning tasks, learning resources and learning supports (Oliver, 1999; Oliver & Herrington, 2001). According to the AUTC (2000) project website learning designs "describe the various frameworks that can be used to guide the design and choice of these elements in the development of a learning experience for students, particularly ICT-mediated learning experiences". Within the educational development phase of the project, learning designs are developed for each e-initiative. These designs will provide examples of good practice in e-learning in a maritime context and support building better practice in e-learning for future initiatives.

The second learning framework is learning themes. Luckin et al., (2012) suggest that understanding and applying "learning themes" can support the development of learning using technology. They developed a framework that can help evaluate the success of innovations in learning and teaching. Learning themes are used in this project to guide the evaluation of each e-initiative and to determine which designs better facilitate each aspect of learning. The learning themes include (Luckin et al., 2012, p. 9):

- learning from experts - approaches that enable learners to access and use information from experts in the field (e.g. resources available on the web) and also approaches that allow outside experts to participate and support learning;
- learning with others - approaches that support collaboration, community building, networking with others and sharing items;
- learning through making - approaches that use digital tools to make, construct, share, discuss or craft something;
- learning through exploring - approaches that support learners to develop skills in finding and filtering information and regulating their own learning;
- learning through inquiry - innovations that support students asking questions, making discoveries and rigorously testing these discoveries;
- learning through practicing - innovations that allow students to practice skills and knowledge, providing challenging problems and immediate feedback mechanisms and often using multi-modal representations;
- learning from assessment - innovations that support assessment and help teachers and learners track their progress and present that information in rich and interactive ways (potentially using learning analytics and other feedback mechanisms);
- learning in and across settings - innovations that allow the learner to use technology outside the classroom and within settings that are relevant to the task.

Aims and scope of the project

The AMC e-initiative project is designed to support lecturers in developing innovative strategies using e-learning to enhance practice. The project's aim is to develop transferable learning designs and guiding principles for e-learning in the AMC maritime context and beyond, through dissemination of results. The overarching question framing this research is: What L&T principles are most relevant to the AMC context? Unpacking this question in each e-initiative (action research project) we ask two questions: Firstly, what educational principles are facilitated by this e-initiative? And secondly, how effective is the e-initiative at facilitating these principles?

Design research will form the methodological framework for this study. This approach is also known as design-based research, educational design research, design experiments and development research, and while similar to action research, it goes beyond that methodology by involving an iterative process of analysis, design, development and implementation of a specially designed model (Herrington, Mantei, Herrington, Olney & Ferry, 2008; Phillips, McNaught, & Kennedy, 2012; Reeves, 2000). The planned e-initiatives will follow a four phase process similar to that defined by Reeves (2000, p. 25):

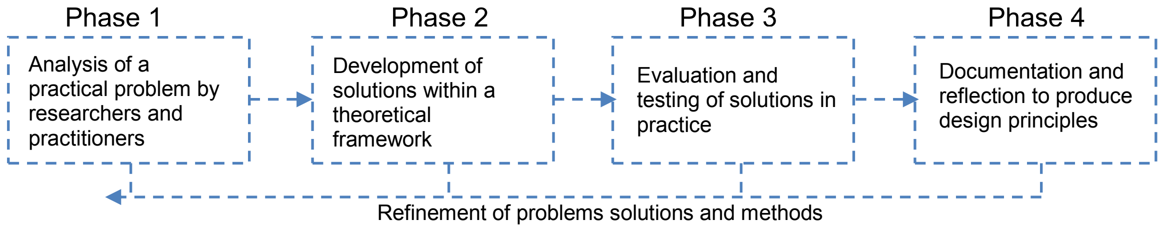

Figure 1. Design-Based Research Model (Reeves, 2000, p. 25)

The e-learning principles for Maritime Education project

The e-initiatives project is anticipated to be conducted over a two year period, with approximately 12 teachers involved in a variety of projects. We have followed a modified version of the design based research process: including 4 phases to identify the e-initiatives, develop meaningful learning tasks through an educational development process, gathering evidence of the task and finally promoting, showcasing and sharing the examples, principles and learning designs to other teachers at the AMC and beyond (see diagram below).

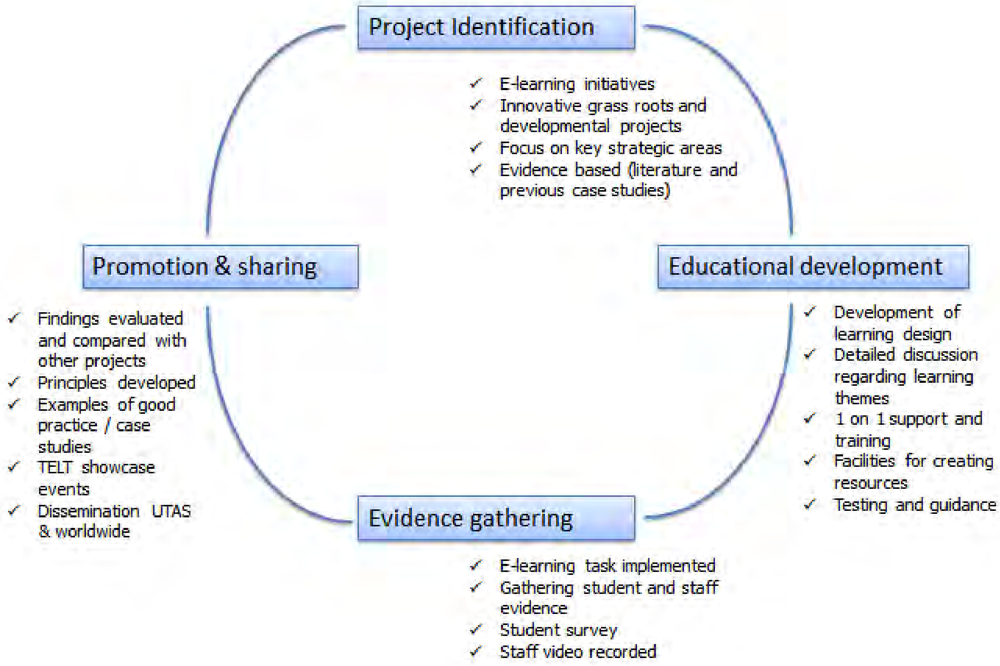

Figure 2. e-Initiative Project Design Model

Phase 1: Project Identification – analysis of a practical problem by researchers and practitioners

At the beginning of each semester a request for expressions of interest for e-initiatives is sent via the AMC L&T Committee and e-Learning Working Party. Lecturers across the AMC can request funding, educational development and support for a project they would like to develop. After the expression of interest the lecturer and an educational developer discuss the project and the potential benefits for learning and teaching. The focus is on innovative or developmental grass roots projects exploring strategies for teaching in maritime education. The discussion is open ended (and often undertaken over a period of meetings) but usually involves discussion and exploration of the following: the types of learning themes inherent in the initiative, technologies that may support the learning theme, the affordances of technologies that are being considered, and design considerations for how to make this idea operational. Together the educational developer and the lecturer develop an *Endnote* library (including documents) of relevant literature within the area of e-learning and start developing a literature scan for their topic. Phase 1 of the project often involves purchasing and allocation of required equipment, software and hardware.

In Semester two 2013 there are 6 projects underway, these include:

- using multimedia feedback to develop problem solving skills and to scaffold an appropriate problem solving methodology in marine engineering;
- developing video lessons of applied mathematics using a document camera and screencapture software;
- enhancing a student focused discussion forum assessment task;
- creating an online academic orientation module for mathematics;
- using video of a field trip and *Microsoft Excel* as an automated feedback mechanism to get distance students into the field in marine biology; and
- the development of mobile simulations for Global Maritime Distress and Safety Systems (GMDSS).

Phase 2: Educational Development – development of solutions within a theoretical framework

At this stage a case study is developed by the lecturer and educational developer to provide more detail regarding the specifics of the e-initiative. Over a period of weeks the learning team will undertake the following: a more detailed discussion regarding learning themes and how they can be implemented within the project; development of a learning design; a video recording outlining the context, purpose, outcome/issue, and what is intended to be achieved; and professional development activities are undertaken to support the technological use.

Lecturers are provided a number of opportunities for developing the initiative and the technological knowledge to undertake it. Professional development opportunities are provided by AMC L&T, one on one at-elbow support is available, and an e-learning working party meets monthly to discuss and share ideas. The e-learning working party is designed to provide an outlet for lecturers to discuss the needs of their project and to develop professional development activities.

Phase 3: Evidence Gathering – evaluation and testing of solutions in practice

Ten to twelve e-learning tasks are expected to be implemented and evaluated over the 2 years. Evidence will be gathered for each initiative over 3-4 weeks. Each case will be evaluated and reported on using the same methodology and survey instrument (with minor modifications to survey questions based on learning themes). Some additional data collection may occur depending on the specific needs of an e-initiative. At the end of this phase the teachers will have implemented their learning design including appropriate resources, supports and assessment items. They will have uploaded their case study to the e-learning website and gathered student perceptions of the learning.

Phase 4: Promote & share - documentation and reflection to produce design principles and disseminating of these principles

The project team will explore the connections between the various projects. They will look at the successes and failings of each e-initiative, exploring the learning themes and how they are interpreted by the variety of strategies used, developing principles for e-learning in the maritime context, reflecting upon these understandings and then finally disseminating these findings freely to all teachers in higher education and in the maritime context. The final phase is the most important phase - using the findings of the implementation and evaluations to create design principles that can be used by other maritime educators (and potentially other lecturers in higher education).

A number of vehicles for dissemination have been decided. All case studies, learning designs and e-learning principles will be published via an AMC e-learning website, as part of an ebook, and at an annual AMC e-initiatives event. Each case will be added to a blog and a poster will be developed for dissemination around the university. A number of papers will be written for national and international conferences in learning technologies and also maritime education.

Conclusion

Adoption of e-learning is not widespread in the maritime learning and teaching context. One potential reason is a lack of understanding and evidence regarding the types of strategies that are effective for maritime students. Another reason is the lack of simple and effective learning designs to guide the process for e-learning development. This proposed project intends to explore and implement a number of learning activities that explore learning themes in e-learning and learning designs appropriate for successful e-learning. The project is likely to yield a great deal of useful, transferable and customisable e-learning knowledge in a maritime context.

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Re-imagining the university: Vibrant matters and radical research paradigms for the 21st century

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This paper invites a re-imagining and re-envisioning of ‘the university’ in its being and becoming (Barnett, 2011a, 2011b, 2013).The paper explores ‘feasible utopias’ (and dystopias) for the university and moves to provoke and promote ‘radical’ paradigms that are *more inclusive* of every*thing*. The ideal of the ‘ecological university’ (Barnett, 2011a) is used to unfold three ‘radical’ paradigms that embrace object-oriented ontologies (through Actor-Network Theory), affectivity (through Non-Representational Theory) and (im)mobilities (through the new mobilities paradigm). The paradigms are intertwined and illustrated through a selection of e-learning vignettes drawn from a larger Australian university ethnographic study of four fully online postgraduate subjects to show how the various sociomaterial affective networks enact different experiences and perceptions of ‘the university’. This is an invitation *to dream* – that we might imagine enriched accounts of the world that embrace vibrant matter(s) for ‘feasible’ university utopias.

Keywords: University, Spatiality, Material Semiotics, ANT, NRT, Affect, Mobilities, e-learning.

To dream …

How might a university re-imagine its being and becoming – its possible futures? How might its spirit speak? What might its spaces ’say’? And what becomes of a university in its (dis)placements across physical and virtual spaces? How might we re-imagine a university’s being and becoming? What paradigm shifts might we consider for the university in the age of ‘supercomplexity’ (Barnett, 1999, 2000)? What wild dreaming might we ponder? The theme of the 2013 ASCILITE conference is ‘Electric Dreams’ to consider higher education’s past, present and future with technologies. This paper then provides a provocation to imagine and dream of an ethics of ‘being’ and ‘becoming’ *with the world* (as distinct from *in the world*) – *with all things* (technologies, spaces, policies, people, software, mobile devices, …) and provokes the radical question of “do objects dare to dream”, and if they do then how might they ‘speak? These are vibrant matters of ‘Electric Dreams’ that provoke ontological questions about the status of objects and subjects and their boundaries. I move towards richer and more inclusive worldviews (ontologies) that embrace matter in all its agency and vibrancy through three ‘radical’ relational emergent paradigms (wild dreaming). The first is through the material semiotics lens of ANT – an emergent relational worldview that embraces complexity and hybridity in the symmetrical treatment of humans and things; the second is through the Non-Representational Theory (NRT) lens that highlights the vitalist affective domains too often (dis)missed in academic research; and the third is through the new Mobilities paradigm that explores the (im)mobilities of people and things relationally. The argument made is that we live in a complex world – a *hybrid* emergent world of humans and things – with all sorts of vibrant matter, and so we need to find ways to research ‘subjects’ and ‘objects’ ‘on the move’ beyond their ‘subject’ ‘object’ boundaries and find ways to have objects ‘speak’ in our research. We might then rethink how we might go on differently with the things/objects/materials/spaces of the world – beyond traditional humanist paradigms that privilege humans at the expense of the too often silent, inert, and ‘passive’ objects of our lives – that we might encompass a human-material embrace where vibrant matter(s) ‘speak’.

This paper explores radical shifts in the ideas and imaginaries of ‘the university’ based on Barnett’s (2011a, 2011b, 2013) evocative and compelling works on “Being a University” and “Imagining the University” in the first part of the paper to unfold a multiplicity of ‘feasible’ utopias and dystopias for the university. I move to consider a productive ecological reading of the university that resonates productively with the radical paradigms proposed. Then in the second part of the paper, the three ‘radical’ (research) paradigms that are more inclusive of complexities, hybridities, mobilities and materialities of the world are outlined. In the last part of the paper, various e-learning vignettes are juxtaposed to show how the materialities, subjectivities and spatialities create ‘the university’ in multiple ways and how it is configured by what *things* can do and ‘dream’ of doing. ‘The university’ then becomes a constellation of vibrant matters that unfold as a network of all sorts of entities (people, spaces and places, policies, objects, labs, technologies and so on).

Re-imagining the university …

Barnett (2011a) traces the origins and evolution of the western concept of a university from the 12th century to the 21st century based on changes in the ideological and physical conditions of the university. *Being* and *becoming* a university are inextricably linked in that “Being a university is always a matter of becoming a university. … being a university is always unfinished business” (Barnett, 2011a, p. 86). (I use the term ‘the/a university’ in the sense of the ideal/idea of being a university – not to imply one singularised idea of the/a university – whilst acknowledging that in practice ‘the/a university’ is multiple enactments.) Barnett’s (2011a; 2011b; 2013) contention is that in the 21st century, we have become “hopelessly” “impoverished” in our conceptions of the university chronologically from its western metaphysical origins in the 12th century to the 19th century, followed by moving to the research/scientific university for a few hundred years, and then to the contemporary entrepreneurial and corporate forms. Universities though existed well before that, “Bait Al-Hikma” (*The Palace of Wisdom*) in 830 AD in Baghdad was the first academy in the Islamic world (Saunders, 2009). Barnett (2011b, pp. 88-89) is concerned that we seem limited to “extending” and “endorsing” “contemporary emerging forms of the university” in entrepreneurial and corporate forms, saying:

> The idea of the university has, of course, undergone many shifts and been subject to varying conceptions over time. For some hundreds of years, the idea of the university was – as it might be said – that of the metaphysical university, reflective of an inquiry that enhanced humanity’s connections with God, or the Universe, or Truth or Spirit or even the State. That conception gave way to the research university which in turn is giving way to that of the entrepreneurial university, which is closely allied to the emergence of a tacit idea of the corporate university. What is striking about this conceptual journey that the idea of the university has undergone over nearly one thousand years is that it has gradually shrunk. Whereas the metaphysical university was associated with the largest themes of humanity’s self-understanding and relationships with the world, the idea of the university has increasingly – and now especially in its contemporary entrepreneurial and corporate incarnations – closed in. The entrepreneurial university is expected to fend for itself, and attend to its potential impact on particular segments of the economy, and become distinctive. This university has abandoned any pretence with universal themes.

Barnett (2011b, p. 89) laments the dangers of this closing in, highlighting that:

> The idea of the university, therefore, has closed in ideologically, spatially and ethically. Ideologically, it is now intent on pursuing narrow interests, particularly those of money (in the service of a national learning economy); spatially, it is enjoined to engage with its region, especially with industrial and business organisations in its environs; and ethically, it becomes focused on its own interests. It will, as a result, close departments in chemistry, or physics, or modern languages or philosophy because it sees such closures as serving its own (usually financial) interests rather than being placed in a wider set of public interests.

We see much of this happening in our current Australian university contexts. So where is the hope for the possibilities of ‘the university’? I echo Barnett’s quest for a more expanded imagining of the university . “Given this closing in of the idea of the university in the early part of the twenty-first century, a key question becomes this: how might the idea of the university be expanded” to open up imagination and new imaginaries of what might be possible “feasible utopias” for the “efficacious imagining” of what a university might be in its becoming? (Barnett, 2011b, p.90). “Feasible utopias”(Barnett, 2011b, p.90):

> seek to imagine, to create, new narratives of the fullest kind that may serve the university and take it forward. This is utopian thinking. And it is an injunction upon the imagination; to strive to form new ideas of the university that could represent the university – now in the twenty-first century – as it might be in the best of all possible worlds. Of course, there is no blue-print available (Jacoby, 2005); there are no ready-to-hand ideals of the university. That is precisely the point; they have to be created anew to suit the circumstances of our age.

Significant in the above is the phrase "to suit the circumstances of our age". This must surely demand not only conceptual ideations about the purpose and nature of 'the university', but is contingent on a whole host of contextual, specific, vibrant matters. The "circumstances of our age" ultimately depend on a host of networks from governments, policies, ministers, spaces, infrastructures, technologies, people, and so on. Vibrant matters (along with ideas) must be considered here as part of the possibilities of re-imagining the university. Barnett (2011b) provides six categorisations for "reading" the university that I summarise in Table 1 (in his 2013 book, he has an extensive listing of further university possibilities beyond this table). Whilst these 'university readings'/categories may seem bounded, there are overlaps, as no university is ever only one ideation or reading, albeit that it may have a dominant reading.

Table 1: On being a university: chronological and feasible utopias

University 'Readings'	**Being/Becoming**
1. The Historic University (Past Being)	'the metaphysical university' 'the civic university' 'the liberal university' 'the service university' 'the research university'
2. The Ideological (Present Being)	'the entrepreneurial university' 'the enterprise university' 'the business-facing university' 'the European university' 'the open university'
3. The Actual (and the Critical)	'the bureaucratic university' 'the corporate university', 'the marketised university' 'the commodified university' 'the capitalist university' 'the performative university' (in the instrumentalist sense)
4. The Emerging University	'the borderless university (Erdinc, 2002)' 'the liquid university (cf Bauman, 2003)' 'the supercomplex university (Barnett, 2000)' 'the virtual university (Robins & Webster, 2002)' 'the networked university (Standaert, 2009)' 'the therapeutic university (Ecclestone & Hayes, 2009)' 'the edgeless university'
5. The Dystopian University	'the soulless university' 'the subservient university' 'the selfish university' 'the selfimportant university'
6. The Utopian University	'the anarchic university' (or 'the iconoclastic university') 'the authentic university' 'the dialogical university' 'the ecological university' 'the chrestomathic university (Young, 1989)' 'the wise university (Maxwell, 2008)' 'the virtuous university (Nixon, 2008)' 'the theatrical university (Parker, 2005)' (in the sense of performance, excitement and anticipation)

As Barnett highlights, these chronological and emergent readings in Table 1, far from being singularised categorisations, can and do exist *concomitantly* in our present day universities. For example, the ideals of the university in its historic university origins of the pursuit of 'truth' and enlightenment, albeit that these might be supplanted by new ideas and pursuits, can still be seen today. The ideological university might be "ideologically neutral" but can still harbour "large projects for the university, connected with large political and/or commercial interests" (Barnett, 2011b, p. 92). The actual (and critical university) might involve both description and critique. The emerging university is fuelled by the technology-rich universities of the 21st century. The latter two categories of dystopian and utopian readings can be superimposed across any of the university readings of 1-4 in Table 1. In the dystopian views (e.g. Brabazon's (2002, 2007) "Digital Hemlock" or "The University of Google" respectively), Barnett (2011b, p. 92) sees these as already upon us in the present:

> These are literally hopeless visions of the university, for they lack hope, hope that there might either continue to be redeeming features of the university in significant form or that new redeeming features of the university might yet emerge. Such images of the university are unduly limited in another sense for these dystopias have already arrived. They merely pretend to be looking into the future when they are simply offering us insight into the emerging university; and offering us, as stated, unduly limited images of the emerging university at that. These dystopias are already with us; are already present. In virtue of their pessimism, their limited scope and their lack of hope, they should not detain us.

Consequently, Barnett (2011b, p. 92) finds hope in the possible utopian readings where:

> … the imagination is heightened (as compared with the previous imaginings of the university). Now, the imagination is beginning to be loosened from the actual and is striving to glimpse future possibilities while being rooted in the present. These imaginings are projections, deriving from a careful reading of the present but striding out, going on, and drawing out a future-possible from the present. These imaginings carry something in them of a yearning for the being of the authentic university.

Barnett (2011b, p. 93) views these utopian possibilities as the not yet "present forms of the university" but that they could be realised. It is Barnett's contention that each utopian vision, as it 'leaps ahead', "never quite severs its links with the present. It opens a gap between the real and the possible but also tacitly promises to close the gap: in the best of all possible worlds, each of these utopias might just be brought fully into the world". Peters (2007: online) also finds potential hope in possible utopias of the technologically-rich universities of the 21st century (Katz 2008a; 2008b).

Peters (2007) outlines shifts across three traditions of evolution of the western university (encompassed in Barnett's earlier conceptualisations) of firstly, the Kantian notion of critical reason, rationality and reflection towards a self-critical enlightenment; secondly, the Humboldtian notion based on self-cultivation, cultural self-understandings, and cultural reproduction; and thirdly, the Leavisite notion of *high* culture based on the cannons of a national literature. Peters advocates that we need to understand these new "techno-cultures in relation to the university where the radical concordance of image, text, and sound sets up new exigencies and promises for pedagogy" as well as "new dangers". He suggests that we might be able to have "mass access and democratic participation" in the shift from the cultural elite origins of the university to mass education via these new promises. But what are the criteria of adequacy and what might suit our circumstances of the age in our re-imaginings of the university?

Barnett poses criteria for adequacy based on five dimensions, posing insightful questions that might sustain, propel or destabilise a conception or reading. His (Barnett 2011b, p.93, original bold) five criteria are (in his 2013 book he extends these to six, adding criticality in the sense of standing out against current innovations):

- **Range**: what is the range of the imagining? Does it have theoretical backing? Is it rich in concepts and ideas? Does it lend itself to an array of practices? Does it have large implications for policies?

- **Depth**: what is the epistemological depth of the vision? Does it reflect or identify large structures, or acknowledge forces, that are present and does it address those structures? Does it connect with actors' experiences? Does it connect with the material world in its complexity?

- **Feasibility**: given the power structures that it has identified, to what extent might the vision be implemented? How feasible is it? Could it be instantiated by individual universities? Could it even be instantiated by the university system as a whole?

- **Ethics**: To what degree does the vision reflect large ideas as to human and social wellbeing and even flourishing? In what ways could its vision be said to be worthwhile? Does it reflect large human principles such as those of fairness and openness?

- **Emergence**: to what extent does the vision lend itself to continuing further interpretations over time? Could it open itself to yet further ideas and imaginings? Could it continue to unfold over time, and in new ways as new situations arise?

So for example, Barnett (2011a, 2011b, p.93) posits and strongly advocates that the 'ecological university' is a strong contender for the five criteria in terms of range as it has "theoretical backing" and is "rich in concepts ('sustainability', 'ecology', 'deep ecology')". Further, the ecological university whilst it also has depth at a conceptual level, provides meaningful explorations of daily practices and at policy level, as it facilitates explorations within and beyond the university across infinite locales and networks. Its ethical starting point is a "concern with the other" (Barnett, 2011b, p. 94). It also implies "emergent qualities" that are contingent and remade and "imagined anew". Barnett (2011b, p. 94) sees the idea of the ecological university as "both efficacious and robust", saying:

> The spirit of the ecological university can be cashed out at the level of the 1-1 pedagogical relationship between a tutor and a student, it can be reflected in a department's or, indeed, a university's self-understanding and its actions in the community, and it can be witnessed in the ways in which a whole university sector moves and is perceived in society. ….The idea of the ecological university, in other words, can be seen to be potent at all the ecological registers (cf Guattari, 2005) of persons, of institutions, of communities, of society and even of the world.

A university then becomes an effect of multiple networks – staying with the ecological theme – a rhizome – taking in the multiple, the heterogeneous and the dynamic – taking in an ethics of *the other*. This ecological metaphor takes becoming *in-relation with* seriously – this warrants a relational emergent ontology *par excellence* that embraces every*thing*. Consequently, I move towards radical utopian imaginings that have at their heart an ecology of *things* – embracing the vibrant matter of the world. This might well be seen as a "responsible anarchy" (Barnett, 2011a, chapter 7) of an ontological epistemological feasible utopia where objects dare "to dream" (Mitew, 2011) and 'to speak'. Whilst the above discussion has centred on the abstract ideations of the university, I move next to explore 'radical' research paradigms (wild dreams) that might better resonate with an ecological approach.

Wild dreams: voicing radical research paradigms

How is it that so many accounts of the world are devoid of things – the vibrant matter of living? And how is it that so many accounts of technology in education are human-centric where machines are silent and passive objects of the world – "invisible masses" (Latour, 1992, 2005)? We live too often with "the silent fragility of the thing" (Introna, 2009, p.42, original emphasis). The status of objects is too often voiced as 'reified objects' (Pels, Hetherington & Venderberghe 2002, p. 3) or "a projection of human agency on passive, dull matter, or dull matter intruding on the subjective realm populated excessively by humans" (Mitew, 2011, p. 3). My radical provocation is to consider the vitality of objects (Knorr-Cetina 1997; Pels, Hetherington & Vandenberghe, 2002; Turkle, 2007, 2008a, 2008b) and their "vibrant materiality" (Bennett, 2010). It is not that humans are set up "in opposition to things" (Dolwick, 2009, p. 35) to act "'on' things" (Dolwick, 2009, p. 35, original emphasis), but rather that they act "with, through, or in response" to things (Dolwick, 2009, p. 35). I extend to materials an *"ontological dignity"* (Latour & Venn 2002) in the centred-human *status quo*. This supports Sørenson's (2009, p. 2) posthumanist stance to "place the human not above materials (as the creator or user) but among materials". Consequently, we need "methodological frontiers" and "crossing boundaries" (Brownlee & Irwin, 2011; Goodyear, 2011; Markauskaite, 2011) in the challenges facing educational research and design (Markauskaite, Freebody & Irwin, 2011). This requires moving beyond traditional subject object boundaries to consider "ecologies of interweaving physical, digital and human resources" (Goodyear, 2011, p. 258). So how might we consider this? I outline three productive paradigm solutions that resonate with an ecological relational stance.

Object-oriented paradigms (where objects dare to 'speak')

There is emerging interest in object-oriented ontologies such as in the work of Harman (2007, 2009), Mitew

(2011) the material feminists (Lenz Taguchi, 2012), as well as interest in the "evocative objects" of daily life (Turkle, 2007, 2008a, 2008b) that configure, mesmerise, proliferate and flourish in the world. Whilst there are various ontological boundary stances here from human and material boundaries being *pre*formed, there is a more radical stance that shakes up the human-material boundary. This radical stance is pronounced in the transdisciplinary material semiotic lens of Actor-Network Theory (ANT) (Latour, 2005; Law, 2004; Law & Mol, 2002) originating form Science and Technology Studies and gaining prominence across multiple fields, for example, in education (Al-Mahmood, 2006, 2008a, 2008b, 2011, 2012; Fenwick, 2010; Fenwick & Edwards, 2010) amongst many other fields. The basis of ANT's approach is a *radical symmetrical treatment of human and material agency* – it is a sociology of relations. It is a performative worldview in that the world is *performed into being* and is constantly *becoming* as distinct from a representational stance of a world 'out there' waiting to be described. Nothing is *pre*formed in ANT, but rather everything emerges and is *per*formed into being in complex hybrid networks. Hence we might gain a *measured wisdom* in how we might "*renegotiate"* (my emphasis) and "comprehend" technologies in our universities "to recombine learning and life in new ways", as Agre, 1999: online, original emphasis) reminds us that:

> … artifacts do not simply drop from the sky. They come surrounded by cultural meanings (liberatory or oppressive, rational or spiritual, stabilizing or disruptive, traditional or modern, elitist or populist, and the like), and they are knitted into institutional arrangements (access, identity, maintenance, budgeting, space allocation, compatibility, intellectual property, and so on). If we focus only on the artifact, then the cultural meanings and institutional arrangements become invisible. In fact, the relationship among artifacts, meanings, and institutions is complicated and variable.

Any new technology has multiple trajectories with challenges and promises. What a university *is* and *should be* is a result of the intersections and adoption of emerging technologies, which highlight political, moral, and normative questions.

Rip (2009) argues for seeing technology through an ANT lens as it embraces emergence and unpredictably. Further, Lewis, Marginson and Snyder (2005, p. 56) highlight the contingency and complexity of universities and the multitude of technological expressions, emphasising "that network technologies are socially embedded and therefore highly variable in their expression". Also, Goodyear (2011, p. 263) highlights the value of ANT's material semiotic approach and the conceptual work ANT has garnered since its inception in the early 1980s, saying: "I am attracted to the insights that flow from thinking about educational systems (a) in terms of relationships that are simultaneously material and semiotic and (b) as depending upon the ongoing 'performance' of their constituent elements" (Goodyear, 2011, p. 262, footnote 6). A sociomaterial hybrid (human and material) approach highlights the vibrant matter of the world and the negotiation processes that allow the various *actors* (human and material) to 'speak', highlighting the *politics of things* (Fenwick, 2010). An ANT analytic potentially explores the minute negotiations of various actors (human and material). ANT accounts can enrich and contribute to performing *richer and more inclusive* accounts that highlight the vibrant matter of the world. ANT's sociomaterial approach is valuable in that "it challenges the centering of human processes in learning (often conceived as consciousness, intention, meaning, intersubjectivity and social relations) derived from perspectives associated with phenomenology and social constructivism, and foregrounds the material" (Fenwick, 2010, p. 104). Whilst this paradigm does rich work in redressing the balance of returning the object into the world, in lifting the materialities of practice up to view, I do not want to obscure or lose the *human* endeavour and liveliness between people and objects. I therefore promote a further paradigm that highlights the affective domain next, whilst maintaining the importance of the materiality of the world.

Affective paradigms (where objects dare to 'affectively charge')

A paradigm that complements well with ANT is that of Non-Representational Theory (NRT) (Thrift, 2008) given its focus on process, emergence and relationality, but it differs form ANT in that it emphasises human imagination and desiring processes. NRT highlights "affective intensities" and "sensuous dispositions" (Thrift 2004) or the "more-than-representational" (Lorimer, 2005, p. 84) to attempt to grasp the liveliness of practices. NRT is a transdisciplinary approach that draws heavily on vitalist Deleuzian ontologies (Deleuze & Guattari, 1988) amongst others to embrace "an affective realm of 'wild new imaginaries', emerging from repertoires of sensation and emotion" (Lorimer, 2005, p. 90). Unlike human-centred psychological explorations of emotion and affect, affectivity here extends beyond purely human subjectivities – embracing energies and sensations that are *discharged through objects and spaces* (Navaro-Yashin, 2009). Through emergent "*affectively charged places of learning*" (Leander, Phillips & Taylor, 2010, p. 336, original emphasis), we might consider how "affectively malleable" the university can become (Leander, Phillips & Taylor, 2010, p. 341) and how desires are (per)formed.

Goodyear (2011, p. 263) echoes the valuable insights and contribution that ANT and NRT can potentially make to “educational research futures”, saying: “… ANT encourages us to open our minds to possible redistribution of work amongst humans, digital and physical actants. Educational researchers will need methods and perspectives that allow them to deal with the complexities of understanding learning in such networks” of the university and beyond. Further, he predicts a move away in educational research from *golden standard* large scale studies and hypothesised studies towards smaller scale design studies (Goodyear, 2011) to inform rich design patterns (Goodyear, 2005; Goodyear & Retalis, 2010) for interpreting and designing learning environments (Goodyear, 2011, p. 260). We need ways then to deal with the fleeting, the sensory, the affective, and the atmosphere of places and spaces to open up spaces for “sensescapes” (Büscher & Urry, 2009) and imagination for the university. This brings with it a need for a turn to an emerging pressing paradigm of the digital age – the mobilities paradigm.

Mobilities paradigms (where objects dare to ‘move’)

The new mobilities paradigm (Sheller & Urry, 2006; Urry, 2007) deals with spatial mobilities of humans and objects made possible by the new connectivities and intensities of the digital age. The mobilities paradigm draws on and advocates transdisciplinary approaches to address sedentary and nomadic aspects of people and objects across various spatiotemporal locales. “Mobilities theory places an unprecedented emphasis on (im)mobility, moorings, dwelling and stillness as much as movement, speed, or liquidity” (Sheller, 2011, p. 2). New ‘mobile methods’ (Büscher et al., 2010) attempt to capture some of the “complex, dynamic processes, including cyber ethnographies, following-the thing, participant-observation on the move such as walk-alongs (Myers, 2011), drive-alongs (Laurier, 2010), being ‘mobile-with’ (Bissell, 2009), mobile video ethnography (Spinney, 2011)”. Mobile methods beyond traditional data capture techniques are needed given the proliferation of mobile digital artefacts and immersive digital environments (Adey, 2009b; Cresswell & Merriman, 2011; Hannam et al., 2006).

We need to improvise methods based on Büscher and Urry’s (2009) insightful paper, *Mobile Methods and the Empirical*, which discusses the new mobilities paradigm calling for methods to deal with physical and digital (im)mobilities across multi-sited ethnographies. We need methods that can deal with this. Various tempos and movements, or “travels” from corporeal, physical, imaginative, virtual, to communicative movements as people, ideas, technologies, and so much more ‘travel’ need to be explored dynamically (Büscher & Urry, 2009, pp.101-102). We need research methods to capture movement, stillness and the liminal across physical and digital environments. Indeed, we need to glean much more from geographical studies of mobility to inform current and future research (Creswell & Merriman, 2011). The new mobilities paradigm requires that we find ways to capture “archaeological glimpses and complexities” (Büscher & Urry, 2009) via immersive and prolonged engagement methods to keep the world open and ambivalent through novel approaches that “engender” “new research entities” (Büscher & Urry, 2009). Useful ethnographic digital tools might include video diaries, digital recorders, webcams, mobile phones, iphones, video analysis software, video capture, time-space mobile diaries, or voicemail diaries via textual, pictorial or digital, real-time capture. Indeed, we need tools to work with *dynamic* data using digital media and hypermedia to see change over time and to capture richer human and artefact interactions (Markauskaite, 2011, p. 244). Yet, these too can miss something of the sensuous and affective, and all tools and methods have limitations. But digital technologies demand that we rethink the university and its locales and infinite enactments across digital and physical spaces – we need ways to deal with the *new geographies*.

Having briefly outlined how these three productive paradigms might enrich how we view the world, I move next to illustrate these paradigms *at work* through various vignettes to show how ‘the university’ is enacted through vibrant matter to produce various readings of the university.

Enacting the university – what *things* can do and ‘dream’ of doing …

I illustrate and juxtapose various vignettes intertwining the above paradigms to highlight multiple enactments and readings of ‘the university’. I highlight the various sociomaterial networks to show how subjectivities, spatiality and affectivity unfold and are intertwined. The vignettes are extracts from a larger PhD study (Al-Mahmood, 2011) that involved a multi-sited ethnography (Leander & McKim, 2003; Marcus, 1998) of four fully online postgraduate subjects in an Australian university. Ethnography was chosen to facilitate prolonged and immersive exploration of participant e-learning engagements. Physical ethnography (Marcus, 1998) and virtual ethnography (Hine, 2000, 2005) were used to gather and observe the minutiae of participants’ everyday practices across physical and digital spaces.

Following university ethics approval, participants were invited to participate in the study (face-to-face, online, phone) and methods to deal with physical and digital (im)mobilities were used (Büscher & Urry, 2009; Büscher, Urry & Witchger, 2011; Sheller & Urry, 2006) to capture various actors across physical and digital spaces. These methods included participant interviews (after subject completions), participant observation, photographic data, and participant reflections across physical and digital spaces over a period of 6-10 months, as well as document analyses. Data were collected from 24 participants – 19 online postgraduate learners, and 5 teaching staff (2 females and 3 males) ranging in age and teaching experiences. Daily scheduled observation diaries of the online subject sites were recorded, and participants were invited to record their reflections and provide images of their various learning spaces. A wealth of detailed data were amassed, and whilst the aim was to add to the world through ANT and NRT lenses, glimpses into human, spatial, discursive and artefact interactions were 'traced', whilst attempting to 'capture' and '(re)present' the sensuous and affective dispositions and spatial ambiences.

In the vignette selections that follow, I juxtapose how "various objects and mundane technologies sensuously extend human capacities into and across the world" (Büscher, Urry & Witchger 2011, p.6), or not, to unfold multiple university enactments and affectivities to highlight what and how vibrant matter 'acts'. I gather fragments of Natalie's (a student) interview responses to highlight some of the significant entities (actors) that mobilise her actions of seeking – via artefacts, machines, windows, screens, and so on – that constitute her online identity, for the most part, as a seeker. Natalie is a mature-age learner who runs her own business from home where her expansively spacious study doubles as her office. She came to the postgraduate e-subject through inadvertent faculty mix-ups that enrolled her in the fully online subject rather than its face-to-face version (not on offer during that semester). She pursued the e-subject for its sheer challenge and experience to explore new learning and extend her skills. She ultimately, however, still decided to enrol in the face-to-face intensive equivalent subject to get that "something more" – *in the flesh*. She studies from her aesthetically rich spacious home study/office, which is airy and flooded with natural light through expansive windows that overlook her lush garden surroundings. I provide a snapshot overview of some of the intersections of Natalie's e-learning practices, identity formation, and spatial configurations of her virtual and physical environments.

> A learner seeking ~ Needing lecturers as guides ~ Asking questions online ~ Receiving answers as gifts ~ Patiently seeking mastery ~ A flat 17" computer monitor ~ Access to the world ~ Pursuing virtual libraries of the world ~ Aiming towards mastery the ultimate goal ~ Being patient with myself ~ And developing bloody mindedness ~ e-Learning fosters self-reliance, determination, perseverance ~ Seeking self-mastery ~ Towards a new form of solitude ~ To stay with something ~ A new sense of solitary self-reliance ~ And online learning is like going to a party ~ Such fun ~ Little surprises ~ Little journeys ~ The element of surprise works ~ That you could discover something ~ A digital and physical library ~ Yet instinctively I would want more than online learning could offer ~ So I will attend the face -to-face subject intensive in the break ~ But online taught me so much ~ I jumped into a pond and I had absolutely no consciousness of what it was about ~ It was a total process of destabilisation ~ and then re-establishment of self …

Natalie sees herself and is configured as a seeker of knowledge, as 'the novice seeking mastery', saying:

> A seeker. I was a seeker seeking answers, a confused seeker at times ….I would only see myself as a learner … which would be also the role of a seeker …. I am the discoverer of the knowledge, within myself, so it's based on experience but I need a guide. …

The lecturer as guide is configured through his wording and online presence as Natalie comments about her experience with the online lecturer, Brian. Despite having never met him in person, she has a strong sense of his presence. She perceives him as *caring*, *excellent*, and *encouraging*, commenting:

> when someone guides me … I'm grateful. Incredibly grateful. When someone takes the time, it's more than giving, it's guiding… I think that's an honour. That's how an academic gains respect. …. All the lecturers who[m] I've had, who[m] I … knew online had … the discipline to address their emails, and answered their incoming emails and answered questions, and probably could read what the student was requesting; they all had their moment for me.

She continues, "the tone … he writes beautifully …. acceptance…". Social presence is a significant factor of any e-learning environment (Clark & Kwinn, 2007; Finegold & Cooke, 2006; Garrison & Anderson, 2003; Henriksson, 2006), and significantly lecturer presence. She emphasises the impact of a lecturer's email on a student, saying, "… one out of every one hundred emails they send will be a life changing experience for someone, which is I suppose what traditionally we looked at lecturers for when we went to the classroom and got that … something!". Here we see "the metaphysical university" enacted.

And yet in contrast, different material configurations and affectivities result for Paul (student), a professional with 20-years' experience as an educator, who sees the student-lecturer email interactions as "formulaic", "going through the motions", saying: "It felt very much like a performance that I was involved in"; "… being a novice and being in someone else's territory that wasn't my own.… I felt like I was performing for him and he was doing the teacher role for me ... Occasionally he would write back and say, 'No, this is not, bold in capitals, what the text says'. And I'd just think, 'Stuff it' … So it felt detached and it felt somewhat authoritarian". For Paul, far from the nuanced sense of care and attention of the email contact with lecturers, disembodiment remains a concern: "I believe the most effective teaching-learning interaction is one that engages the whole person — body, mind and spirit. And I don't know how that gets involved in a virtual process. Maybe it does, but I can't envisage it". Here we see the "soulless university" enacted by virtue of the email medium for Paul. Further, we witness the "commercial" "enterprising" university when Lillian, a softly spoken, poetic Chinese student, who majored in English literature in China, says: "I think that makes it more efficient …. The teacher can go out and leave and do his own business, but still he can teach and I'm also, I mean, efficient at doing this, and I type out and didn't go to the classroom and sit in [for] three hours. … But also I think that makes peoples' interaction and communication less and less and so makes you feel other things are more commercial". Further, with increasing conceptualisations of education as a commercial enterprise (Marginson & Considine, 2000) and knowledges as mass commodities, what will it mean to teach in a *borderless* university — at what cost, to whom, and for whom? In the enterprising university, we see students, lecturers, and the academy (by virtue of its buy-in to LMS companies) as consumers, so knowledge readily becomes a commodity. Enterprising in a commercial sense is not always experienced positively, despite the implied e-learning flexibility and access it might imply, because here the pedagogical student-teacher relationship becomes one of facilitator-customer/client. And significantly of concern in digital university spaces, are the longevity and visibility of participant textual contributions — these risky spaces of the LMS are potentially "there forever" (Al-Mahmood, 2012). This leads to censured selves and further self-censoring and extra editing work. The LMS platforms configure the learning spaces as potentially risky, where participants' vulnerabilities are visible when Sandy suggests that one's "stupidity is there for the whole online community" to see. Here we see the 'performative university' in the sense of surveillance and accountability issues being enacted. LMSs support neoliberal agendas that placate critical scholarly debate/resistance by virtue of having 'access' to everything to being a 'consumer' of everything.

Despite the risks, access at our fingertips still tantalises and inspires, so for Natalie her *access to the world* in her connectivity online allows her to access spaces beyond institutional e-subject boundaries. This access to world libraries from the comfort of her study extend her online learning experiences. Here university boundaries become fluid. She highlights her expansive connectivity or seemingly paradoxical *solitary connectivity* to the world, saying, "… in a positive light, you don't actually have to be alone. You don't necessarily have to be bored in this world. There's a world that you can interact with instantly, which is very similar to me for what the library was like: you could grab a book and you could be somewhere or learn something or do something. And I think that's a gift a lot of people … don't act on". She continues: "... The joy of studying at night, reading at night. … I enjoy the aloneness, the solitude really." As Arnold (2002, p. 235) so aptly echoes, "When I sit at my computer, log-on and join the Internet, I and the glass screen conspire together to approach the world … and possibilities and experiences are afforded that would otherwise be denied …. These are technologies that extend our agency, our way of being in the world". In terms of Natalie's pedagogical learning spatialities, here interview extract is revealing: "Ok, my space would be in relation to an online course, would be in the context of my relationship with an academic, preferably, a text, and also having access to other students, through a relationship on the computer, a computer relationship". Her sense of ambience and location of the virtual learning spaces was created by her. "I created it. That space, that's why I like it when the sun goes down. So the space I create is probably in an Australian sense, hopefully it's a meditative space, a space where I can think and contemplate, and learn and grow". The attenuations of hybrid subjectivity render Natalie as a "troubadour of knowledge"; a Deleuzean "rhizomatic" (Deleuze & Guattari, 1988) knower and a *hybrid cyborg* (Haraway, 1991). Natalie's is an emotional geography (Bondi, 2005; Crouch 2000) of exploring at ease and "traveling-in-dwelling" (Lury, 1997: 83). The world is explored within secure, private, and comfortable enclosures of home and study, though Internet connection is at student expense; we see the well-worn networks of economic and social capital (such as connections, places, resourcefulness) *speak loud*, in this instance.These insights highlight how the 21st century digital universities are experienced and perceived. We have here the 'fluid university'/'the emerging university', 'the metaphysical university' being enacted *par excellence*.

In contrast, in this next vignette, I illustrate global physical mobility and a "dwelling-in-travelling" (Lury, 1997) as reflected in Jasper's (student) "borderless university" and the digital university's potential for developing countries. Jasper is an Australian international professional, whose working/learning spaces are mobile as she travels to various countries due to her work. She says, " I've lived in France and in Rwanda and Ethiopia and Africa, but I have gone on short assignments to a range of countries in Asia, Central Asia, Russia, and the Pacific …". She highlights how "fantastic" the Internet is, saying: "I love the Internet so it seemed to me a fantastic use of the technology …. the resources that are available are absolutely fantastic. …. I find it just remarkable. … Particularly … working in a developing country, the power that it gives to people is just fantastic". She indicates that e-learning is "certainly an effective way of learning in this day and age when people are not necessarily in one place for an academic year", saying:

> … I basically was working full-time and I had to finish the last part of the course when … I was on an assignment there in Sri Lanka, and so basically I was full-time and I had to do that in the evenings and I had to get an assignment in …. So that was a bit of a challenge but I was able to do it . .... I was further away and it was dreadful … the hours were different …. It certainly didn't make any difference in terms of the interaction with the other students because it was still there.

Jasper's is a nomadic practice that extends universities across time and space. She says: "It's been really good. I'm just amazed by it really. … I told people, 'This is fantastic. It's this new learning'. It means anyone can have access to higher learning. All they need is access to a computer. … it's just an amazing thing, [for] people who are at home or … can't get to a university, it just opens up so many possibilities". She narrates an anecdote of Tibetan monks in Mongolia surfing the web in a tiny remote village café, recounting the powers of connectivity.

> … I was doing some work in Mongolia … often [in] developing countries it's really useful for the Internet because there [are] so many Internet cafes because people can't afford computers so there are lots of Internet cafes and the telephone systems weren't too good. So I would go to the Internet cafes for my personal work … and as I was there a couple of times … Buddhist monks came in and they were searching on the Internet … it was just somehow … the contrast between the Buddhist monks and their robes, their saffron robes … sitting in an Internet café surfing the Net and making contact with Buddhists and goodness knows what else all over the world, it was remarkable! … It was just marvellous it seemed to me that connection was a characteristic of the power of the Internet for people.

Throughout these illustrations, we see enactments of the university in its digital manifestations as multiple – we have the metaphysical university where knowledge is sought above all else with and through a master/an expert/a guide – a mastery and seeking of knowledge – and yet self-reliance too. We see the borderless/fluid/networked/virtual university where knowledge, people, and libraries of the world are accessible at one's fingertips. We see dystopian/performative/soulless universities that produce anxious and self-censured participants, and so on. The university is multiple – it can take on "different forms, different performances, different realities, that co-exist in the present" (Mol, 1999, p. 79). Different material, spatial and social configurations lead to different university readings/enactments. Matter is vibrant and active *par excellence*.

To re-envision … daring to dream of better feasible university utopias …

My envisioning is that we need radical paradigms to address the complexity and richness of the world and the idea of the university and its process of knowledge-making. "*Practices of knowing are specific material engagements that participate in (re)configuring the world*. Making knowledge is not simply about making facts but about making worlds, or rather it is about making specific worldly configurations " (Barad, 2007, p. 91, original italics). The paradigms proposed for the technology-rich 21st century university impel new approaches to research that bring into question the boundaries of humans and objects and the nature of knowledge-making. Today's technology-rich universities have shaken up the notion of *traditional spaces* of the university– changing knowledge and research boundaries to more "fluid" and "dynamic" possibilities. We need to experiment with how to create sustainable and ecological university learning/knowledge spaces, keeping these issues alive on our research agendas (Ellis & Goodyear, 2010; Riddle & Howell, 2008). We need to *renegotiate* – in all sorts of ways and with all sorts of *things* – how we go about learning, researching and living.

If we have at our base a willingness towards sustainable and ecological imagination then we can find ways to re-imagine 'feasible utopias' for our university. A more encompassing and ecological approach might involve embracing a "learning-centric university mission" (Ellis & Goodyear, 2010, p. 153) to dream and evolve beyond the contemporary entrepreneurial and corporate university towards new imaginaries of the university that have at their heart reclaiming and re-enacting anew 'the spirit' of the university. To consider our possible (e)learning futures, we need to take heed of what Agre (1999, p. 39) says in that "Our choice is not technology versus no technology, but a wider determination of the concepts and the values that higher education should embody" so that we might become and be an ever imagining university (Barnett, 2013). In our imaginings, however, we must take heed that "in the unfolding of socio-technical networks – our contemporary technically advanced society – things and humans reflect and sustain each other. We co-constitute each other's possibilities to be – as such, they (we all) matter, both politically as well as ethically" (Introna, 2009, p. 29). We need to move beyond the online/offline divide and the human/material divide to encourage affective and hybrid ways to analyse and interpret e-learning and e-teaching practices. Consequently, emergent university environments of the present and future require new methodological and transdisciplinary approaches to address the complexities of the (im)mobilities of people, material artefacts, spatialities, technologies, affectivities, and sensualities – to highlight richer relational rhizomatic ecologies of and for the university. This is an invitation to dream – that we might imagine different worlds, better and more encompassing worlds towards feasible utopias for our universities that embrace vibrant matters.

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The design of formative blended assessments in tertiary EFL programs: A case study in Saudi Arabia

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Despite a rise of blended learning approaches in foreign language education programs, little research has examined how such integration of technologies in the classroom affects assessment designs. Any 'electric dreams' that technologies will improve learning remains unproven without clear assessment designs. In this paper, we undertake a qualitative study of formative blended assessments within an English language program at a major Saudi university. Data was gathered through observations, semi-structured interviews and Participatory Design (PD) sessions. Thematic analysis of the data resulted in four emergent themes: definitions, approaches, alignment and requirements. After setting out and discussing the four themes, we conclude our paper with suggestions for further research.

Introduction

Blended learning, or the principled integration of technologies in face-to-face educational settings, has long been accepted as a mainstream concept throughout higher education (Bonk & Graham, 2006; Garrison & Vaughn, 2008). Despite the rise in integrated pedagogies, blended assessment practices remain underdeveloped. Issues of blended assessment design include the definition of constructs when new media are used as modes of presentation (McLoughlin & Lee, 2010), establishing 'modal free' criteria that focuses on activity and not technology, and recurrent challenges in professional development (Corbel, 2007).

Although improvement in the proficiency in English as a Foreign Language (EFL) in Saudi Arabia is a key national educational goal, students in most EFL language programs have limited exposure to English. Accordingly, interest in e-learning, m-learning and Blended Language Learning (BLL) has been based on increasingly the opportunities of students to be exposed to English. Innovative learning materials, that simulate life in the target language, have been produced, and they even include aspects of the target language culture (Jauregi & Banados, 2008).

In this paper, we examine the challenges of developing blended assessment designs within the context of English as a Foreign Language (EFL) programs in Saudi Arabia. The role of EFL in Saudi Arabia is complex, important and pressing; EFL has been intertwined throughout the modern history of Saudi Arabia, and widespread EFL proficiency is seen to be a large part of a national agenda that seeks to foster greater international engagement. Traditionally, education in Saudi Arabia has been authoritarian and efforts are underway to evolve culturally appropriate ways to teach and learn to fit in with a changing world. Technologies, especially the Internet, are widely available throughout tertiary institutions and are instrumental in recent pedagogical innovations (Khan, 2011; Mohammed, 2011). One 'electric dream' then, of Saudi Arabia, is that global networked technologies will spur innovation throughout education.

To limit the scope of our paper, we set aside 'high stakes' or 'summative' instrument designs to focus specifically on formative assessment processes. Specifically, we highlight ways that assessment tasks can be blended into a technology rich EFL curriculum. After reviewing key concepts, we describe our qualitative study, detail cycles of analysis, and set out emergent themes. We conclude our paper with the wider implications of the study, and make suggestions for further research for a range of blended enviroments in tertiary education.

Issues in formative blended assessment design

Formative assessment practices focus on enhancing learning and prompt students to take more responsibility for their own work (Black & William, 2009; Stiggins, 2008) through the development of 'intrinsic motivation', improving 'self-esteem', fostering 'independent learning methods', as well as developing 'the ability to improve cognitive strategies in solving problems' (Wei, 2011).

Chapelle (2008) suggests that technologies can have three purposes in assessment. Educators, Chapelle writes, may want to create instruments and tasks that can be administered more efficiently than 'paper and pencil' formats. Another purpose is to create equivalent versions of 'paper and pencil' tests that can be used at different sites. A third purpose, according to Chapelle, is to utilize technologies to be better able to meet specific needs of a program, so that they are fit-for-purpose and aligned with established policies and pedagogical approaches. Here, our focus is on the final purpose.

If we follow the logic set forth by Chapelle (2008), then the use of technologies in EFL programs implies that learning designs must align with insitutional policies (Middaugh, 2010), departmental cultures (Boud, 2007) and classroom practices (Hill & McNamara, 2012). Accordingly, designs may help meet the students' expectations that assessment tasks are authentic, unambigous and allow for choice and flexibility throughout a university course (James, McInnes, & Devlin, 2002). Ideally, departmental staff would forge common practices within an overall course, as well as within their individual subjects, to create innovative tasks and activities to meet global standards (Healey et al., 2009).

Teachers, by and large, nonetheless resist large-scale curriculum change as they are forced to reconsider familiar practices and established approaches and materials. Coming to terms with e-monitoring, or the process of faciliating student development through online conferencing, for example, requires changes in technical and professional methods (Crisp, 2007). Further, as Vaughan (2007) writes, education professionals find that "bureaucracy and inertia can prevent changes in the curriculum, course structures, and timetables" (p. 81). The professional development received by educators regarding assessment influences their attitude towards the depth and breadth of student assessment. Students, in turn, may consider whether or not they have been fairly or unfairly assessed (Stiggins, 2008).

Designing assessments that are 'fit-for-purpose' has long been seen as a challenge in meeting the needs of 21st century learners (Cumming &Wyatt-Smith, 2009). As learners become more fluent with technologies, they expect teaching approaches will enhance their own digital literacies and social practices (Guth & Helm, 2010). Measuring the effortless movements from online to face-to-face interactions demands recognition of a range of skills that may not be easily captured in assessment (Kress, 2009). A final challenge, especially pertinent in language learning, centres on construct definition. How is listening, for example, to be understood when digital video clips are used as modes of presentation? How does the concept of 'participation' change between online forums, streamed video calls, social network sites and in the classroom? Gruba (2006), and others (Ockey, 2009; Royce, 2007), have suggested that educators must move beyond seeing language as a division between four sub-skills (reading, writing, listening and speaking), and see communicative interactions as much broader, intertwined and multimodal; blended langauge learning approaches in language learning are now well developed (Gruba & Hinkelman, 2012).

In light of concerns raised in previous studies, we now focus this study on three questions:

1. How do language teachers and learners design formative blended assessment tasks and activities?
2. What 'considerations' or 'standards' do language teachers and learners use in the design of formative blended assessment tasks and activities?
3. What issues arise when language teachers and learners design these tasks and activities?

Method

Given the lack of established work in blended assessment for language learning, we take a qualitative, exploratory approach to our present work. In short, we worked with participants in online sites, through interviews and extended discussions at the Fait University English Language Centre (FUELC, a pseudonym) at a major Saudi university. The centre provides ten EFL training programs for both university and community students who need to develop their language abilities for work or other purposes. Within the university, FUELC assists with the English language training for around twenty courses throughout the sciences and humanities. The Centre is also responsible for delivering language programs for more than 10,000 students every year as a requirement of their mainstream studies.

To fulfil its responsibilities, FUELC has hired more than 80 EFL teachers to run programs in the male and female campuses. Teachers come from Western and Middle Eastern countries. English language programs are generally provided at the early stages of students' studies, in first and second year; however, for other students who need much greater language competence like students studying medicine, English training is provided throughout the degree. Recently, Fait University announced the establishment of a preparatory year program similar to a foundation year in Western colleges. Students have to finish the preparatory year before enrolling in their mainstream studies. In this year students are required to finish a comprehensive academic EFL program before enrolling in their mainstream subjects. This has resulted in an excessive load of responsibilities for FUELC in the provision of different English programs at different university levels. In our study, seven male participants agreed to help us. Each participant is male because Saudi cultural practices prevented us from interacting directly with potential female participants; at Fait University, there is a male campus and a wholly distinct and separate female campus. The two campuses are located approximately 25kms apart.

At the start of our data collection, the particpants were asked to interact with an online website called Englishtown© [www.englishtown.com]. Following this, we interviewed participants to gain knowledge of their understanding of formative blended assessment. The participants then engaged in two sessions tasked with the design of formative blended assessment prototypes for writing and speaking. In each session, the participants were divided into two groups – students and teachers (Table 1).

Table 1: Participants' profile

No	Participant	Education	Experience
1	William	PhD in Applied Linguistics	EFL teacher
2	Sultan	MA in Applied Linguistics	EFL teacher
3	Soliman	MA in Applied Linguistics	EFL teacher
4	Isaac	MA in Education, CELTA certificate	EFL teacher
5	Salim	BA student	EFL student
6	Turki	BA student	EFL student
7	Omar	BA student	EFL student

Four of the participants were teachers with language qualifications, and three were students enrolled in a Bachelor of Arts. With the partipants, we observed them using a website, interviewed them and worked with them in collaborative discussions. Data was collected in 2012 after we sought relevant ethical approval from The University of Melbourne.

Ahead of institutional development of its own resources, we sought to find an appropriate site to investigate and familirize participants with formative blended assessments design. Websites like Englishtown© provide an ideal forum for such a purpose as it is a website that is well-known, and that it is already being used in different language centres. Throughout this online interaction, the understanding of participants', especially students, in how to use the website properly, was checked regularly. Participants were free to interact when and where they wanted. The objective of this online interaction – the first stage of activity for the participants – was to provide them with an opportunity to explore how formative blended assessments could be designed and delivered.

We conducted semi-structured interviews with each of the seven participants. The primary aim of our questioning was to encourage participants to reflect on their interaction with the Englishtown© website; secondly, we used the interview to ask them about their ideas concerning formative blended assessment design issues in detail. We asked them questions about their interaction experience with Englishtown© and their thoughts and observations regarding formative blended assessment design. To spark discussion, we also provided participants with an assessment scenario at the beginning of the interview to encourage them to think about their preferred forms of blended assessment. The prompt provided us with a clearer image of how participants wanted to assess/be assessed in speaking and writing. We audio recorded, and then transcribed, each interview.

Participatory design (PD), or the involvement of a range of stakeholders in the processes of constructing artifacts (Cardenos-Claros & Gruba, 2010), lay at the heart of our investigation. As we conducted two PD sessions, we sought to work with participants to design blended assessment prototypes. To start, participants were divided into a group of students and a group of teachers. Each session commenced with brainstorming on what participants felt should be included in the design of writing and speaking formative blended assessments. The final designed prototypes for writing and speaking were completed by the teachers' group and later presented to the students for final checking.

In our first PD session, we worked with students to design the paper prototypes for the writing and speaking assessments. In the first half of the session, we discussed creating a writing assessment prototype and then working on designing a speaking assessment prototype. These student participants were novice in assessment task design, and one role we took on as researchers was to facilitate the process for them. To help ground our sessions, we based the target design on commercial learning materials that were familiar to the students and used widely throughout the region. Students worked collaboratively during the design, and used large sheets of paper to record their work and brainstorm ideas in a convenient manner.

Our second PD sesssion comprised four teachers who were asked to also design similar writing and speaking assessment prototypes. We started this session with the teachers by brainstorming possible issues with the students' design ideas. Based on student ideas, the teachers designed their own assessment prototypes. The teachers were well engaged throughout the design process, and appeared to welcome the chance to talk about their ideas and air concerns.

Findings

The findings of this research involve the reflections of the seven participants regarding their Englishtown© interaction and their design of formative blended assessment tasks and activities in language programs. These reflections were noted from transcriptions of the taped interviews and from the written notes taken during the interviews and the PD sessions. The main data set – the transcribed interviews of the participants – was organized (according to subject matter) into four themes (or categories): definitions of formative blended assessments, approaches, curricular alignment and requirements (Table 2).

Table 2: Summary of emergent themes and sub-themes

Themes	Sub-themes raised
Defining and placing	Mixing of approaches Enhancement of learning
Approaches and practices	Feedback Interaction through new media
Alignment	Relevance Rubrics
Key requirements	Awareness Technical support Preparation

In the following section, the four themes are listed and their sub-themes elaborate on. This is followed by a discussion of each theme in relation to earlier research.

Theme 1: Defining formative blended assessments

Throughout our data analysis, one of the most prominent themes to emerge is the concern with defining what, specifically, blended assessment may be. Understanding how the participants defined blended assessment provided insights about the standards, and practices, that they associated with the prototypes we offered within blended assessment participatory design workshops. The participants saw blended assessment as a mix of on- and offline assessment practices and as way to enhance overall learning (Table 3).

Table 3: Defining formative blended assessments

Sub-themes	Definition	Sample data
Re-use of established practices	Established or 'traditional' practices are seen to be able to fit within blended learning curricula.	*Mixing traditional assessment forms with technology, that would be the best option I think in assessing the students' abilities in language skills* (William, interview 1, p4, lines 21-22).
Assessment practices	Reaffirm the principles of formative assessment, regardless of modality.	*The basic purpose of assessment is to increase learning. So ask, how is this assessment going to enhance this?* (Soliman, interview 3, p7, line 4-5.)

The most common definition provided by the participants on the meaning of blended assessment was that it was the mixing of two approaches, the traditional approach and the more modern approach that uses technology. Isaac explained the mixed approach nature of blended assessment:

> *I think it's important to keep in mind that it is blended assessment, so part of the assessment is done other than online and the other part is done online. So, both venues complement each other and I think keeping that in mind, it can be done effectively* (Interview 4, p.1, lines 29-32).

Soliman saw blended assessment as an opportunity, but cautioned that such an approach needs to be clear on how it enhances learning, and that educators need to question purported achievements:

> *So what are the objects that you want to achieve through this blended assessment and how are they going to enhance the learning of the student? Basic purpose is the learning, how this assessment is going to enhance this or what sort of…what purposes…you are going to achieve through this assessment, and how it is going to be different from the traditional…This must be kept in mind* (Interview 3, p. 7, lines 4-15).

In summary, it was apparent in our analysis that the participants considered that any attempt to introduce blended assessments must be grounded in solid principles of assessment, and justifiable according to the achievement levels they promise. In embracing blended assessment (as they all appeared to approve of it and respect it as being beneficial) the participants also acknowledged that it involves technology, and a variety of forms of assessment that utilize different technologies, from computers and all they involve, to even the use of mobile phone devices and *Skype*.

Blended assessment was defined simply as a mixture of assessment approaches. The participants may not have truly recognized that blended assessment designs require a far greater understanding of developing construct definitions that align with innovative approaches to teaching. Throughout the interviews, it was clear that participants saw blended designs as a potential enhancement of current practices (Bonk & Graham, 2006; Frey & Fisher, 2001).

Theme 2: Approaches and practices to formative blended assessment

The formative blended assessment methods theme refers to how speaking and writing are assessed within the framework of blended assessment. This theme is relevant in the study because the theme provides information about the first research question and third, which asked how language teachers design formative blended assessment tasks and activities in blended language learning programs. In this part of our analysis, we focused on how blended speaking and writing could be assessed. Two of the main methods cited by the participants included feedback and virtual interaction (Table 4).

Table 4: Approaches and practices

Sub-themes	Definition	Sample data
Feedback	Educators are aware of the need to provide comments.	*Feedback is always important. Instructors should have feedback sessions with students to know whether this process is being applied effectively or if there are some shortcomings* (Sultan, interview 2, p. 8, lines 26-29).
Interaction through new media	New technologies can be integrated into blended	*I think it's good to use a video camera, or webcam or Skype* (Salim, interview 5, p. 2, lines 15-16).

	assessment practices.	

Providing feedback was the method cited by several participants as a method for students understanding their levels of writing and speaking. However, William also explained that:

> *Online assessment…may help the students improve their speaking skills and writing skills also if they get feedback as quickly as possible and with positive feedback from the teacher* (William, Interview 1, p. 3, lines 3-6).

Isaac also spoke about why feedback is essential in online assessment. When asked to clarify whether feedback should be made through face to face interaction or through online methods, Isaac explained his view that online feedback was good, and that further face to face feedback was also helpful:

> *…perhaps a couple of post-questions just to reflect on what they wrote. You know, further thoughts just to confirm - you know, sometimes we need confirmation. I think actually we always need confirmation when assessing* (Isaac, Interview 4, p. 5, lines 10-12).

Within the theme *approaches and practices,* feedback and interaction through new media appeared to be the common method the participants articulated in blended assessment. Feedback refers to the teachers' articulation of the weaknesses and strengths of students performance in the language class while virtual interaction refers to the assessment conducted online to determine the competency of students in both writing and speaking. Participants prefer using technologies, and it is only natural that students would want to use them in their learning. As well as this, learning and being assessed with various forms of technology must be more interesting and motivating for the students.

The participants' desire for more feedback in assessment may reflect a move away from traditional teaching and assessment where 'rote' learning was more prevalent. As it is now commonly accepted that deep learning arises when it involves forms of learning that are student directed, then it makes sense that students have more involvement (and receive greater feedback) in their throughout their learning journey.

Both in the preparation and implementation stages, feedback is an element required for both teachers and learners. In the view of the administrator and teachers, feedback serves as their basis in improving the system of blended assessment operation. On the other hand, students felt that feedback benefits them by identifying their strengths and weakness in learning the structure of the language, and that it uses this information to subsequently provide lessons to enrich their learning. Feedback, both from teachers and peers, is crucial to formative assessment (James et al., 2002; Stiggins, 2008).

Theme 3: Curricular alignment

Clearly, the teachers were aware of a need to align what they taught with their assessment practices. Throughout observations and participatory design workshops, these teachers indicated a need for rubrics to include specific criteria for assessment, and relevance in terms of what is being assessed in the curriculum (Table 5).

Table 5: Curricular alignment

Sub-themes	Definition	Sample data
Criteria	There is a perceived need to create and announce clear assessment criteria (perhaps in the form of rubrics).	*I would like to suggest that preceding each test there must be some kind of rubrics.Rubrics must become a standard in assessment. Rubrics may need to be distributed among instructors to modify according to their situation, the level of their students and things like that.* (William, interview 1, p. 9, lines 15-18).
Relevance	Educators recognize the need to align what is taught to what is being assessed.	*This should be linked to my textbook, the exam or the assignment should be linked to my textbook, just like this*. (Turki, interview 6, p. 2, lines 22-23).

The participants perceived curricular alignment as something which needed to be based on rubrics which contained the predetermined set of criteria that needed to be assessed. William suggested that each test and each skill should be represented in a rubric. Soliman noted that the marking criteria, or rubrics, should be made available to students at the very start such that they can familiarize themselves with the marking criteria:

> *…this way they will be having that thing in the[ir] mind and it is not any sort of bad thing that you are going to make secret. Just like in TEFL or in IELTS examination[s] students already know how [they] are going to be assess[ed] and what is the marking criteria. In this way they will act accordingly* (Soliman, Interview 3, pp. 2-3, lines 40-43).

Assessment content also needs to be relevant to the curriculum. The participants in the study believe that there should be a clear connection between the learning tasks and the methods of blended assessment used by teachers. As Turki (a student) said in Table 5:

> *This should be linked to my textbook. The exam or the assignment should be linked to my textbook, just like this* (Turki, Interview 6, p. 2, lines 22-23).

Clearly, as the participants are aware, assessments must align with set curricular goals, including what topics and subject matter a student needs to learn in a given period (Bloxham & Boyd, 2007; James et al., 2002). Indeed, clear criteria set out in the form of rubrics are important; overwhelmingly, the participants wanted to know in detail what it is that they are expected to learn. Hill and McNamara (2012) suggest that formative assessment requires establishing clear pedagogical goals from which rubrics can be created. For language learners specifically, rubrics can be made to meet levels of competency (e.g., beginners, intermediate, advanced) in a range of skill areas.

Theme 4: Establishing requirements

As we worked, it was apparent that requirements were necessary in the planning stages of formative blended assessment prototypes, and that they involved an understanding of an awareness of the approach, technical support, and preparation (Table 6).

Table 6: Establishing requirements

Sub-themes	Definition	Sample data
Awareness	Educators are familiar with the key challenges of technology integration in the curriculum.	*Students and teachers must be aware of how to use technology* (William, interview 1, p. 2, lines 5-6).
Technical support	Educators recognize the need to have technical support for blended designs.	*We need technical support, and trained staff, plus the students who know how to use this technology* (Soliman, interview 3, p. 1, lines 34-36).
Preparation	Educators understand that assessment construction takes time and dedicated preparation.	*There's a preparation stage and this is standard in all assessments* (Isaac, interview 4, p. 2, line 34)

The participants made many interesting and perceptive comments regarding the use of blended assessment requirements. According to Isaac, for example, there needs to be planning involved prior to the implementation of blended assessment, and this needs to consider issues of student concern. Isaac explained that through brainstorming with students and among teachers, a plan that captures the needs of students can be achieved:

> *There are certain skills that you emphasize that you expect to see, there are certain topics you want to remind your students about. Just to make sure that when the time comes, when the actual assessment time comes, they're well-oiled and ready to go, they have their engines running* (Isaac, Interview 4, p. 2, lines 34-40).

One of the requirements of blended assessment is having the awareness of how the process can be accomplished. For this, the participants generally agreed that in order for blended assessment to be implemented, there should first be awareness. They stated that there needs to be an understanding of how blended assessment operates, both in terms of how it can benefit teachers and students and how the method can be implemented. William explained:

> *Sometimes we have access to online resources but we don't have the ability to use them, how to*

access the relevant information. We don't learn how to make the online tests and how to conduct those tests (William, Interview 1, p. 2, lines 2-3).

Another requirement cited by some of the participants was the need for technical support. The implementation of blended assessment needs technical assistance so that both teachers and students know how the process works. William explained the importance of technical support in the implementation of blended assessment:

They should also provide technical support. That's really important in this context because if I don't have any technical support in the lab and I'm going to assess the scores online and there is a problem, it may create a problem for the students and for myself and assessments going on (William, Interview 1, p. 2, lines 21-24).

The responses of the participants indicated that a clearly defined preparation or planning stage should be standard in all assessments, and this should be followed by the implementation stage. The planning stage ensures that the goal is reflected in the blended assessment plan. In the implementation stage, both teachers and students need to have awareness and skills in terms of how blended assessment will be conducted. Technical assistance is needed to guide both teachers and students in becoming more at ease and knowledgeable in using technologies.

Emergent themes point to two implications. First, there must be an understanding of what the assessment is as part of their overall development of 'assessment literacy' (Taylor, 2009). Secondly, there must be an understanding by both the assessment designers, and the students, of how to use technology (Levy, 2009; Oxford & Jung, 2007). Such preparation is essential to the success of blended assessments. The fact that this arose from the research indicates a shift in thinking. Perhaps in the past, when traditional assessments involved little discussion and almost no feedback with students, there may have been a greater emphasis on the syllabus and course content (Miyazoe & Anderson, 2010). Student voices must be heard (Stiggins, 2008). Again, careful planning and preparation is important for the full implementation of formative blended assessments.

Implications and suggestions for future research

'Electric dreams' fueled by the innovation of principled integrations of technologies would become nightmarish if not well guided. It is clear from our work that professional development is essential to the successful design and implementation of formative blended assessments. Within the context of our study, we found strong support amongst participants that innovative approaches to foster greater student engagement would be welcome.

Secondly, we were left in no doubt that feedback is a crucial factor in effective assessment. Within the Saudi context of FUELC, there is a need to develop further understanding of how differing modalities (e.g., written, audio-recorded, video-recorded and/or live responses) may be combined to provide learner feedback. As we are familiar with the site, we are aware of work-load issues that new practices may foster; accordingly, we can only suggest that work with centre and university senior administrators be undertaken to determine the most appropriate ways forward. Would teachers resent being involved in a wholesale curriculum reform, or greet the opportunity as a opportunity for innovation?

At the site of study, assessment rubrics were seen to be an essential element. Participants saw that clear criteria could provide a transparent means of aligning the assessment with learning outcomes. Working with students, we need to see how the information in rubrics could be easily and readily interpreted by students. Having been assessed on their formative work with set criteria, do students follow up in specific areas that are identfied as weak? Potentially, the identification of specified areas of improvement would require the FUELC to provide additional resources for learning support.

Beyond the immediate study, having more voices, using a wider and more diverse sample of students and teachers, would help to better discern levels of awareness of the concept of blended assessment in language learning. Accordingly, a possible step in further research is to develop survey questions based on the emergent themes alongside an awareness of potential problems that arise with blended learning (Stracke, 2007). Further, we see the need for a better framing of formative blended assessments. At present, published expert work in assessment tends to divide assessment to be either online (Crisp, 2007) or based within a physical institute or classroom. We see a need to develop specific guidelines for work in blended environments. After re-affirming core assessment principles, perhaps further studies could address issues to do with construct defintion, characteristics of modality, alignment with innovative practices and policies, as well as professional development. Though our focus here has been on formative stages, we understand that classroom-based assessments may well have 'high stakes' consequences (Rea-Dickins, 2006) and are seen as a focal point ripe for innovation with technologies (Garrett, 2009; Shohamy, Inbar-Lourie & Poehner, 2008).

Conclusion

Our purpose here was to examine the challenges of designing formative blended assessments. Using a qualitative approach, we investigated student and staff perceptions in assessing EFL in a Saudi Arabian tertiary institute. We used observations, interviews and PD sessions to explore the views of participants. In our analysis, four major themes emerged. First, when defining formative blended assessment, the participants highlighted that it was a concept that could involve the inclusion of both traditional and established practices, while the conventional goals of formative assessment such as increasing student learning remained dominant objectives. Secondly, the participants revealed that their views on blended assessment supported that educators needed to use such frameworks to provide meaningful feedback to learners. Participants argued increasing inclusion, and ultimately convergence of technologies, within the blended learning concept. The third theme concerned issues of curricular alignment, and participants saw a strong need for explicit rubrics within blended assessment designs for language learning. Finally, there was a need to have a keen awareness of what was required to build a robust system for blended assessments, including technical, professional and pedagogical training resources for ongoing professional development.

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Using simple technologies to improve student engagement and success in an online applied-science course: A case study

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Centre for Teaching and Learning
Massey University

The first year course, Soil Properties and Processes is a core course of two of Massey University's applied science degrees. The course is offered both internally and via distance education. The course has a reputation for difficulty, and end of year pass rates for the distance offering are generally below 50%. In 2013 a new student engagement strategy was adopted to increase this pass rate. The strategy was built upon engaging students at the start of the course with a pre-course screening quiz, and then maintaining ongoing engagement using multimedia resources accessed through the university's Learning Management System (Moodle). This strategy represented a paradigm shift for a lecturer more comfortable with email and phone correspondence, but has been well received by students. The strategy has consistently engaged students throughout the first semester of 2013, and highlights how a focused, low-technology approach can improve student experience.

Keywords: distance teaching, science, engagement strategy, student experience

Introduction and Context

Massey University is a New Zealand University that offers both traditional (internal) and online (distance) education. Soil Properties and Processes is a compulsory first-year course of the Massey University Bachelor and AgriCommerce and Bachelor of AgriScience degree programmes, and integrates physics, chemistry, biology and the soil resources of New Zealand. Time is allocated equally through the course to each of these subject areas. The course is offered internally as a single-semester course (in both Semesters 1 and 2) and via distance teaching as a double semester course. The course is regarded by students as one of the toughest first year courses at Massey. Lecturers attribute this reputation to the integration of physics, chemistry, biology and pedology in a single course.

Soil Properties and Processes has a history of low pass rates. This is particularly apparent for the distance offering of the course; for three of the past four years distance pass rates have been under 50%, and significantly lower than the pass rates for the equivalent internal offering. A large proportion of students who do not pass the distance offering are DNC (did not complete) or WD (withdrawn) students. However, the failure rate for students who manage to complete the course is low.

In 2013, a new approach was implemented to better engage distance students enrolled in Soil Properties and Processes with learning. The long-term objective of the approach is to increase the completion rate to at least 70%, and the pass rate to at least 60% by converting a large number of the DNCs and WDs into completions.

Traditionally, the distance offering of Soil Properties and Processes was taught with limited student engagement where students are expected to work through a printed study guide, to submit four assignments through the year, and to attend a final exam. The new approach aims to increase retention and success by focusing primarily on early and ongoing student engagement. This presentation describes the initiatives that were adopted to improve student engagement. It presents a case study for how simple technologies used via a Learning Management System (Moodle) have been used to increase engagement in a first-year university applied science course.

International data shows that retention and completion rates of online courses are generally lower than those for similar, traditionally delivered courses (Park & Choi, 2009). Statistics from Massey University reflect this pattern. Not only are retention and completion rates linked to government funding in New Zealand (courses with pass rates lower than 50% are under threat of cancellation of government financial support), but the publication of performance league tables means that there is a tendency for this data to be associated with poor academic performance (Maathuis-Smith, Wellington, Cossham, Fields, Irvine, Welland & Innes, 2010). Thus, such courses are under close scrutiny at Massey University.

The literature identifies a number of factors that cause students to withdraw or fail to complete. Recent work by Jeffrey, Milne, Suddaby, & Higgins (2012) identifies a lack of engagement at the start of the course as having the biggest impact on the retention of online students. Additional factors influencing retention and success include a poor quality learning experience and failure to cope with the academic demand (Yorke & Bendon, 2008) and inaccurate expectations of the course (Braxton, Vesper & Hossler, 1995, Nadelson et al, 2013, Yorke & Bendon, 2008). The online/distance learning environment brings additional challenges for students, including negotiating the online environment, information overload and a de-personalised learning environment (Willging & Johnson, 2004).

Online teaching also presents challenges for teachers, including the challenges of new teaching methods (Claybon, 2008) and the development of a new set of skills such as technology and design skills, process management and distance mentoring and motivation skills (Heilman, 2008). In order to be successful, any strategies for increasing student engagement and success must also be manageable, sustainable and cost-effective for the lecturer and the organisation (Stepanyan, Littlejohn, & Margaryan, 2010). Tablet technologies such as iPads are becoming ubiquitous in higher education institutions, and an increasing body of literature attests to their positive impact on student engagement (Manuguerra & Petocz, 2011) and their ability to provide transformative learning experiences (Miller, 2012). The portability and ease of use of the iPad was also a prime consideration for a lecturer who spends a great deal of time travelling due to participation in international research projects.

Methodology

Any strategy for engagement introduced to a lecturer has to be manageable, simple and easy to implement in the face of a demanding teaching and research schedule. Two key areas were therefore chosen for focus: ensuring that the students who enrolled on the course had the scientific knowledge and skills required to understand the course content, and ensuring that students were engaged by the course and felt supported by the lecturer during their studies. An additional challenge in the initiative was presented by the lecturer's unfamiliarity with online teaching technologies. This meant that any strategies or tools needed to be easy to learn and quick to use and maintain. Three simple, quick approaches were employed which represented collaboration between a lecturer and teaching and learning consultant:

<u>Pre-course quiz</u>. Students enrolling into Soil Properties and Processes come from a range of education backgrounds. Some students are recent secondary school graduates, some are professionals, while others are completing the course for interest, or as part of a part-time degree, and may have received no scientific education for more than ten years. In order to better appreciate the range of background knowledge within the class in the areas of math, chemistry and biology, an 18-question quiz was developed. Although students received marks for the quiz, the grade was used only to determine whether students could gain direct access to the course, or required a lecturer consult prior to access. The grades did not form part of the formal assessment. The questions were designed such that any student with a general secondary school science education (the background knowledge we pre-suppose in the course) should be able to achieve 100%. Students were offered one attempt at the quiz. Those who achieved 60% or higher were automatically granted access to the course via Moodle's conditional release function. Those who scored less than 60% were directed to an email link, via which they could schedule a consult with the lecturer before release was granted.

Not only did the quiz provide an indication of the level of background knowledge of the course participants, it was also a useful indicator of individual student engagement as the Moodle completion tracking function allowed the lecturer to identify those students who had not attempted the quiz ten days after the course had begun. As these students would have had no access to course content, they were identified as not engaged, and the lecturer was then able to follow up individually with these students.

Video updates. Completion of the pre-course defined students as engaged with learning at the start of the course. The challenge for the lecturer was to continue this engagement after the first three weeks. Short video clips of the lecturer in conversation with the (student) viewer have been used to meet this challenge. In each video, the lecturer provides a week-by-week progress chart, reviews what should have been achieved in the previous week, and defines what should be the learning objectives for the next week.

Educreations. Educreations is a free iPad app that allows the user to turn the ipad into an interactive whiteboard to create video tutorials containing voice narration, images, videos, drawings and animations. The video tutorials are stored online, and students access them using any type of computer or mobile device, via a link on the course Moodle page. The app was used both pro-actively, to create short lessons on topics that the lecturer had identified as traditional trouble spots for students, and reactively, to answer specific questions posed by students. Information about new video tutorials was posted to the course news forum so that all students had access.

Results and Discussion

Despite being a very simple strategy, the introduction of the pre-course quiz was remarkably effective in providing students with an understanding of the level of science knowledge required, and on the actual nature of the course. Two students voluntarily withdrew from the course without academic penalty, and with a full refund of fees as a result of this quiz.

Students who achieved more than 60% in this quiz were automatically given full access to the Moodle site using the conditional release function. Students scoring less than 60% had to request access to Moodle from the lecturer. This allowed the lecturer to engage these students in conversations about the nature of the course, and to provide guidance and academic support where required. Regular prompting was required to ensure that all students completed the quiz within the first three weeks of the course. The consequence of non-completion was the potential classification of the student as 'non-engaged' with a warning of possible cancellation of enrolment, in accordance with Massey University policy. Two enrolments were cancelled as a result of this initiative at the end of the first three weeks.

Both video updates and Educreations tutorials have been very well received by students. In the first 5 months of the course, eight Educreations tutorials and 15 video updates were loaded onto the Moodle site for the course. A class survey conducted during a three week break between the two teaching semesters showed that 80% of the class always watched the videos, with the remaining 20% of the class sometimes watching the videos. 70% of the class had watched all of the Educreations tutorials, with 10% watching some of them.

Feedback received from students has been perhaps the greatest indicator of the apparent success of the engagement strategy. A selection of comments to the question 'Please describe the positive aspects of this course that are assisting your learning', are listed here:

> "When someone asks a question it is always replied to … has been a big help. Having not only a visual method explaining a point but also the audio as well has really helped"
>
> "Even though it is called distance learning I feel like other students and staff are not so far away, you only have to ask, and help is there."
>
> "The video updates and educreation clips are invaluable."
>
> "I think the interaction ….. is doing is excellent and should be used in other [courses]. The ipad short clips are excellent and could be used as a basis of short bullet point lecture"

The lecturers' experience and perspective

The success of any engagement strategy is not only defined by the student response. The strategy and technology employed must also be sustainable from the perspective of teaching staff. In the Sciences at Massey

University very few academic staff are specialists in teaching; most have heavy research and management workloads. This description is true of the lecturer involved with the case study presented here. The strategy described in this paper therefore represented a mental and perhaps confidence challenge to the lecturer involved. Use of video and an iPad in teaching was a paradigm shift for an academic more comfortable with email and phone correspondence with distance students. The initiative was approached in early 2013 with a fair degree of trepidation. But students quickly responded, and stated their appreciation of the level of engagement they were experiencing. The pre-course quiz and video updates were seen as a useful part of the learning experience. Very early positive feedback provided encouragement that the initiative should be continued, and an iPad was bought in April to implement the Educreation phase of the strategy. This in itself was a learning experience: the lecturer involved had never before used an ipad for any application.

This case study shows that an approach to better student engagement does not need to be high-technology. No specialised software has been used to implement the described strategy. Technology used has been limited to the university's learning management system, an iPad and a laptop web camera. Although the measurement of student completion and success is ongoing at the time of writing this paper, it is clear from course analytics and student and lecturer feedback that both students and lecturers are more engaged in the course, and that students are responding positively to the increased sense of lecturer immediacy and the provision of multi-media support.

The ability of university lecturers to respond to the challenge of improving online teaching will depend on teaching staff more widely adopting currently-available and low-technology strategies that promote student engagement to improve the distance student learning experience. The immediate task for the lecturer and consultant responsible for the current initiative is to communicate the experience and effect of the strategy, and to support other staff who wish to promote and achieve similar engagement.

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Creating engagement and cultivating information literacy skills via Scoop.it

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The appropriation of digital content by higher education students reflects a significant change in learning paradigms. The traditional classroom model in which instructors were the sole source of information and knowledge is being replaced by a model that allows learners to collect, share and co-create knowledge. By integrating Scoop.it into the curriculum, this paper explores the potential of Scoop.it for both creating engaging learning experiences and cultivating digital information literacy skills. It will be shown that while Scoop.it facilitates engagement, it was less successful as a tool for improving students' digital information literacy skills.

Keywords: digital curation, digital information literacy, student engagement, higher education

Background

With the fast-paced churn of new technologies and platforms, is tertiary education keeping up? Are we realising our dreams of connected, innovative and interactive learning experiences and environments or do they remain a mirage?

Web 2.0 technologies are rapidly changing the ways in which human beings locate and access information. The paradigms for learning have evolved beyond the traditional classroom—in which the instructor was the source of all knowledge and the students the passive recipients of information—to a new model of interactive and collaborative learning. 21st century students want to take advantage of digital technologies for seeking and sharing information and be as digitally competent in their learning lives as they are in their personal lives. Universities therefore have a responsibility to develop digitally literate graduates in order to meet both student expectations and the demands of employers.

This study emerged in response to, firstly, student complaints about the outdated nature of essays. The students reported that, as ICT students, they were not motivated by an academic writing task that did not allow them to engage with technology, as is their chosen field and, secondly, in light of a need to cultivate digital information literacy skills among higher education students. As such, this study assessed the potential of digital curation tools for engaging and motivating students and explored whether or not today's students possess the digital information literacy skills required to live and work in an increasingly digital society. That is, can students determine the value of information they find online that is not peer-reviewed or published in an academic journal (blog posts, wikis and content on social media platforms for example)? This paper reports on the findings of a five-month study in which a cohort of 258 first year, first semester ICT students, across three demographically diverse campuses, were given the task of curating their own Scoop.it page. While the institution mandates that this *Communications for ICT* course continue to have a writing component, the digital curation platform, Scoop.it, was integrated into the curriculum to make the experience more interactive for the learner.

The results of this study indicate that the students enjoyed the addition of the Scoop.it task and were more motivated to complete the assignment than they would have been if it had entailed the submission of an essay alone. However, while Scoop.it was an effective engagement tool, the students in this study reported frustration at being unable to use the digital content they had curated in their essays, due to institutional mandates for the exclusive use of peer-reviewed sources. The curation task was also successful, although less so, as a mechanism for cultivating digital information literacy skills among this cohort of students. Although most students exhibited the signs of analysis and criticality that constitutes digital information literacy, a number of students noted their inability to determine the value of web-based content; that is, online information that is not peer-reviewed or published in an academic journal, such as blogs, wikis and social media content.

Digital Curation

Although definitions of curation have been proposed (Scime, 2009; Wheeler, 2011), they do not take into account the meta-cognitive processes—synthesising, analysing, and prioritising—that are at work in the curation of digital content. The following definition, which encompasses the digital competencies that are required to effectively use digital curation tools, will thus be used for this study. Digital curation is:

> Curation is an active process whereby content/artefacts are purposely selected to be preserved for future access. In the digital environment, additional elements can be leveraged, such as the inclusion of social media to disseminate collected content, the ability for other users to suggest content or leave comments and the critical evaluation and selection of the aggregated content. This latter part especially is important in defining this as an active process (Antonio, Martin & Stagg, 2012).

In response to the over-abundance of information now readily available on the internet, a suite of digital curation tools have emerged and are aligned with the need to locate, select and synthesise web content. Scoop.it is one such tool that allows the user to select, preserve, maintain, collect and archive digital assets in one place. In this study, Scoop.it was incorporated into the curriculum to provide a more interactive and engaging learning experience that was more closely aligned with the expectations of this particular cohort of ICT students. The assessment task was also designed to assess the students' digital information literacy skills. By enabling the students to curate digital content on their Scoop.it pages, and justify their inclusion of this content, we were able to observe how the students determined whether or not a particular piece of content was credible and, by extension, if they exhibited digital information literacy skills. The researchers selected Scoop.it for this task as it adheres most closely to the aforementioned definition of curation.

Student Engagement

Student engagement is a broad term implying a wide range of activities. Generally speaking though, engagement is often discussed in terms of involvement with class-mates, lecturers and the university community, both in a content-centered and social sense. The degree of involvement is recognised as a factor contributing to student success (Kuh, 2002). A student's involvement in university life has been shown to produce a more determined approach to their studies which in turn leads to a greater sense of satisfaction. (Astin, 1993; Pascarella & Terenzini, 2005). A positive feedback loop is created that leads to a student's eventual success.

In more specific terms, Chapman (2003) defines engagement as a "students' cognitive investment in, active participation in and emotional commitment to their learning." In this project, student engagement was created by giving students an assessment task aimed at cultivating a sense of ownership and responsibility over their own learning journey. It was surmised, in lieu of Chapman's definition, that the public-facing nature of the digital curation platform would motivate students to invest greater effort into the task as the final product was accessible to both peers and the wider community. Previous research (Laird and Kuh, 2005; Coates et al, 2008) has found that students who engaged in forms of learning involving higher cognition, such as analysing, synthesising, and evaluating, tended to be more engaged. Hockings et al (2008) likewise suggested that students who reflect, question, conjecture, evaluate and make connections between ideas are more deeply engaged. In order to complete the Scoop.it task, the students were required to reflect on and critically analyse whether or not an item of digital content was credible. The students could then use the content they had curated to inform their written essay.

Digital Information Literacy

Digital literacies have been defined as the capabilities that individuals require to live, learn and work in a digital society (JISC, 2013). A recent JISC report highlighted the value that employers place on graduates who can communicate effectively via digital media and who can critically judge the validity and reliability of online information. However, higher education institutions continue to mandate the exclusive use of peer-reviewed materials in course assessments to the detriment of web-based content, such as information found in blogs, wikis and via social media platforms. As such, students are not developing the skills they require to be able to determine the credibility of this digital information. One of the aims of this study was to shed light on the claim that undergraduate students indiscriminately use web-based resources with little respect for or understanding of conventional study practices. For the purpose of this research, digital information literacy refers to the set of 21st century skills outlined by the *Laboratory for Innovative Technology in Education* at the University of Houston (2013). Digital information literacy includes the ability to effectively analyse and evaluate evidence; to analyse and evaluate alternate points of view; to synthesise and make connections between information and arguments; and to reflect critically, interpret and draw conclusions based on analysis. Several universities (California State University, 2006; University of Central Florida, 2006) have begun initiatives to improve students' information literacy skills. However, without effective assessment, it is difficult to know if these programs are paying off. This problem was similarly encountered in this research. In order to measure whether or not the Scoop.it task had a positive effect on students' digit information literacy skills, the students would need to complete an information literacy skills test, such as the Educational Testing Service's iSkills assessment, both before and after the completion of the Scoop.it task. The research method did, however, serve as an indicator to determine the extent to which this cohort of students perceive that they have the combination of technical and cognitive skills needed to operate in an increasingly digital world and it enabled us to assess whether the students exhibited signs of digital information literacy skills.

In this study, digital information literacy was assessed by asking the students to submit an annotated bibliography in which they justified the web-based content that they collected for their Scoop.it pages. The "appropriation of texts external to the university has significant implications for the changing status of knowledge and what counts as authoritative and legitimate" (Lea & Jones, 2011). Universities continue to advocate the use of peer-reviewed content but what they are failing to understand is that in an ever-changing discipline, such as ICT, this is no longer the most current information and students need to be able to draw on digital content in order to be privy to the most up-to-date information in their field. Building on this premise, and to ensure that a degree of quality is maintained, there is a need to understand how today's higher education students interpret the reliability and authority of web-based content that is not peer-reviewed.

Method

Conduct

258 students enrolled in a first year, first semester *Communications for ICT* course constituted the participants of this study; 90% of which were Bachelor of IT students. The first assessment item for this course was divided into two parts. Part A of the assignment, due at the end of week 4, required the students to create a Scoop.it page about an area of ICT that they were interested in pursuing in their career. The students were presented with a list of 28 possible topics which included a range of new and emerging technologies, such as 3D printing and Google Glasses. The students were able to choose one of the topics on the list or, alternatively, they were able to select a topic of their own accord. Over a four-week period, the students were required to collect a minimum of five pieces of digital content for inclusion on their Scoop.it page. As part of the Scoop.it task, the students were also able to post comments, suggest content to other users and reuse content (re-scoop) from other Scoop.it pages. At the end of week 4, students submitted their Scoop.it URL to the course lecturer. Part B of the assignment, due at the end of week 6, was a 1000 word essay, which constituted a more formal continuation of the Scoop.it task (Part A). The students had a choice of two topics for their essay:

- Topic 1: Based on current trends in the IT industry, what might be the five most important technologies in the next 5 to 10 years?
- Topic 2: Based on your chosen field, research what developments are likely in that field in the next 5 to 10 years?

Topic 1 was intended for students who needed help clarifying their career aspirations, while Topic 2 was aimed at students who had a clearer idea of their future direction. In order to complete the essay, the students were required to source peer-reviewed materials. Although the students could use the content they had curated on Scoop.it to inform their search, university requirements insist that students use peer-reviewed sources exclusively for their essays. In addition to the formal essay, the students were asked to justify the inclusion of five pieces of digital content that were published on their Scoop.it pages, which constituted a web-based annotated bibliography. Part A of the assignment, the Scoop.it pages, was worth 10% and Part B, the essay and digital annotated bibliography, was worth 20%.

Data Collection Methods

To maximise the usefulness of the results, three different data collection methods were used for this research:

- Documentary evidence: Students submitted their completed Scoop.it pages which were then graded out of ten, based on the overall quality of the presentation and the satisfaction of the minimum criteria for items of content required. Content analysis of the annotated bibliography was also undertaken.
- Survey questionnaire: Following the completion of the assessment task, an online survey that consisted of 21 questions was distributed to the participants. Three of these questions were open-ended and allowed the students to comment generally on the Scoop.it assessment task.
- Focus group: To supplement the survey data, a focus group was conducted two weeks later with a group of six students who participated voluntarily.

Results

Documentary evidence

258 Scoop.it pages were submitted and given a grade out of 10. The average mark across the sample was 7.35. For each student, the Scoop.it topic, the number of scoops (pieces of content they had collected), the number of re-scoops (pieces of content they had collected from another Scoop.it page), and the total number of items they had collected were calculated. Only 22 students scooped the minimum five pieces of content, whereas 236 students scooped more than six pieces of digital content. Expressed as a percentage, 91.5% of students collected more than the five pieces of content that were required for the assessment task. 206 re-scooped content from another Scoop.it page and 52 did not. In percentage terms, 79% of students utilised the re-scooping functionality of Scoop.it, while 21% did not. 48 students (18.6%) selected a topic that was not included on the list provided.
In order to assess digital information literacy skills, the students' perceived ability to determine the value of web-based content was explored and content analysis of the annotated bibliographies was undertaken. The researchers looked for traits that are indicative of digital information literacy skills, according to the Houston definition aforementioned, including the ability to analyse, synthesise, and interpret the value of information that is found online, which is not peer-reviewed or published in academic journals. One of the students observed that a piece of content was retrieved from an "official product website thus making the information reliable [and] also fairly recent..." Another student noted with regards to an article that "although… [it] has some older content on it, I found that it still explains what we should expect when it comes to future web browsing and how we're starting to use our actual computers less now that we can do the exact same things on our simple tablets and mobile devices. Great read and quite relevant."

Survey Questionnaire

89 students, out of 258 active enrolments, took-part in the voluntary online survey, yielding a participation rate of 34.5%. In response to the question, 'Which statement best describes how frequently you engaged with Scoop.it?, 44% of respondents indicated that they checked their Scoop.it accounts at least once a week, while 40% of respondents checked their accounts at least three times a week. 2% of participants checked their Scoop.it accounts every day and 14% indicated that none of these responses was applicable. This latter group was asked to specify how frequently they engaged with Scoop.it. The most common response was that participants checked their Scoop.it accounts once in the four week period and collected the five pieces of content required for the assessment task during this single use of Scoop.it.

Question	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Total Responses	Mean

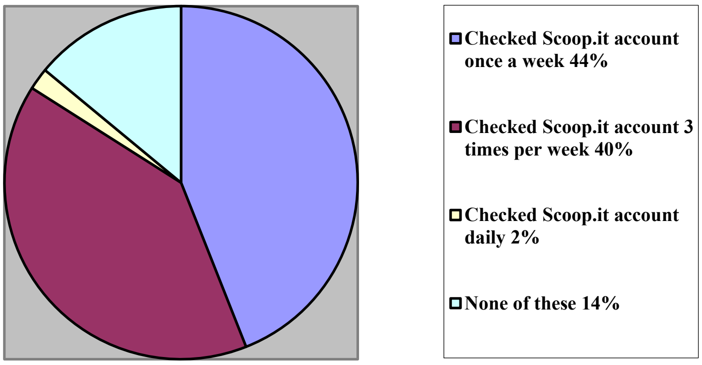

Figure 1: How frequently students engaged with their Scoop.it accounts expressed as a percentage

The students were asked 'what were the primary benefits of using Scoop.it? (Check all that apply) Survey respondents were presented with five possible responses:

- Learning how to assess the value of web-based content
- Learning how to use a new digital tool
- Engaging with my topic
- Using digital content in my essay
- Networking with other students

69% of respondents indicated that the primary benefit of using Scoop.it was 'Engaging with my topic', while 62% suggested that 'Learning how to use a new digital tool' was an advantage. 53% of students said that the main benefit of Scoop.it was 'Learning how to assess the value of web-based content'.

For Likert-scale items, student responses for Strongly Agree and Agree were collapsed and the same was done for Strongly Disagree and Disagree. The students were asked to indicate 'To what extent do you agree or disagree with the following statements.' Table 1 shows the students' responses to these statements.

Table 1: Student responses to the question: To what extent do you agree or disagree with the following statements

The use of Scoop.it helped me develop my critical thinking skills.	8	17	22	29	8	84	3.14
As a result of using Scoop.it, I feel I can make judgments about the value of digital content.	4	15	29	32	4	84	3.20
As a result of using Scoop.it, I feel I can synthesise and organise ideas and information.	4	8	23	40	9	84	3.50
As a result of using Scoop.it. I feel I can make judgments about the currency of information.	5	13	30	31	5	84	3.21
As a result of using Scoop.it, I feel I can analyse content in-depth.	5	13	35	29	2	84	3.12
As a result of using Scoop.it, I feel able to cite web-based content.	4	16	23	32	9	84	3.31
As a result of using Scoop.it, I feel confident in my ability to use web-based content in my assignments.	3	11	26	32	12	84	3.46
As a result of using Scoop.it, I feel I can distinguish between good and bad web-based content.	7	14	31	22	10	84	3.17

These statements were designed to assess whether or not the Scoop.it assessment task could be used to cultivate digital information literacy skills among higher education students. A total of 84 responses were received and, of this figure, 49 students indicated that as a result of using Scoop.it they feel able to synthesise and organise ideas and information, compared to 12 who did not. 44 students said that as a result of using Scoop.it, they feel confident in their ability to use web-based content in their assignments, while a further 41 students suggested that as a result of using Scoop.it, they are able to cite web-based content. In contrast, 14 students remained uncertain about how to use web-based content in their assignments and 20 were not confident citing digital materials. 37 respondents agreed that Scoop.it helped them to develop their critical thinking skills, while 25 disagreed and 36 students felt confident in their ability to make both judgements about the value of digital content and the currency of information. 19 students disagreed that the Scoop.it assessment task had enabled them to make value judgements about digital content or to assess the currency of information.

In order to assess whether or not the students were motivated to use Scoop.it and if the digital curation platform helped to clarify their career aspirations, the students were asked to indicate the extent to which they agreed or disagreed with the following statements. Table 2 shows the students' responses to these statements. Of the 84 responses received, 63 students said that they enjoyed using Scoop.it for the assessment task compared to 9 who did not and 12 who neither agreed nor disagreed. 55 students agreed that they were motivated to use Scoop.it to complete the assessment task, compared to 11 who disagreed and 18 who were undecided. 48 survey respondents indicated that Scoop.it helped them to determine area of ICT they were interested in, compared to 16 who did not. 47 students believed that they discovered areas of ICT that they were previously unaware of as a result of using Scoop.it, compared to 18 who did not and 45 students agreed they learnt more from using Scoop.it than they would have from an essay alone, while 17 disagreed. 38 students agreed that the Scoop.it tasked helped them to clarify their career goals, compared to 26 who disagreed and 20 who were undecided.

Table 2: Student responses to the question: To what extent do you agree or disagree with the following statements

Question	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Total Responses	Mean
The use of Scoop.it has helped me clarify my career goals.	9	17	20	30	8	84	3.13
The use of Scoop.it has helped me determine the areas of ICT I am interested in.	9	7	20	39	9	84	3.38
As a result of using Scoop.it, I have discovered areas of ICT that I was previously unaware of.	9	9	19	32	15	84	3.42
I learned more from using Scoop.it than I would have from writing an essay alone.	10	7	22	27	18	84	3.43
I was motivated to use Scoop.it to complete the assessment task.	4	7	18	37	18	84	3.69
I enjoyed using Scoop.it for the assessment task.	5	4	12	45	18	84	3.80

The students were then asked a series of questions that were designed to assess whether or not they would use Scoop.it again if given the opportunity. Table 3 shows the students' responses to these statements. 58 students suggested that they would take another course with a Scoop.it component, 9 would not, while 53 would use Scoop.it in another situation, compared to 16 who would not. 50 survey respondents agreed that the use of Scoop.it enhanced their learning experience, compared to 13 who did not and 22 who were undecided. When asked whether or not they would continue to use their Scoop.it accounts after the assessment task had been completed, 35 respondents indicated a desire to continue using their account, while 20 students said that they would desist with the platform and 28 were undecided.

Table 3: Student responses to the question: To what extent do you agree or disagree with the following statements

Question	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Total Responses	Mean
The use of Scoop.it enhanced my learning experience.	7	5	22	42	8	84	3.46
I would take another course with a Scoop.it component.	5	4	17	40	18	84	3.74
I would use Scoop.it in another situation.	7	9	15	39	14	84	3.52

I will be able to use Scoop.it in my future studies.	5	8	19	40	12	84	3.55
Scoop.it is a valuable research tool.	7	6	16	45	10	84	3.54
I will continue to use my Scoop.it account after the assessment task is completed.	9	11	28	28	8	84	3.18

The students' responses to the three open-ended survey questions were analysed and key themes were identified. Two themes emerged: motivation and information literacy. In terms of motivation, the students acknowledged their enjoyment of the assessment task, particularly as an alternative to the standard essay. In the words of one respondent, "I found using Scoop.it to create a bibliography much more appealing than doing so by more common methods—making it enjoyable rather than just plain boring." Another student said "Thanks for providing us with a more entertaining assessment task. I am the kind of student who doesn't like writing tasks and this made it a lot more enjoyable and I feel like I got a lot more information out of using Scoop.it than I would a text-only task." The students also expressed their desire to continue using Scoop.it and to put additional effort into the task than was actually required for the assessment itself: "While I was looking for sources via Scoop.it, I found I was genuinely interested in the sources that were recommended." Another of the respondents said "I really enjoyed using Scoop.it in my assessment task. I found myself reading an article that was suggested and then going off on a tangent looking at related topics. That is what I love about Scoop.it; it made it easy to find interesting information that I was able to use in my assessment…"

With regards to digital information literacy, the survey responses suggested that one of the issues with Scoop.it was that a large percentage of the content that was generated was not peer-reviewed: "The content [Scoop.it] suggested for review was not very academic so I used the Scoop.it add-on to add the journals and such." One of the students acknowledged that, although Scoop.it "gave me greater knowledge of the topics that I was discussing", he/she was still forced to look elsewhere for sources to complete the essay as the Scoop.it content was not peer-reviewed: "It did give me great exposure to the major players (researchers and companies) that were on the cutting edge of my topic. It was those names that I then used to find sources of better quality (corporate research material, peer-reviewed journals)." Another student similarly acknowledged the lack of peer-reviewed materials: "None of the sources were peer-reviewed on Scoop.it yet we were apparently meant to only use peer-reviewed sources for the essay." In terms of using Scoop.it to cultivate information literacy skills, one of the students said that "while I answered neutral for some questions regarding the development of some skills, it is only because I have year of tertiary experience. I certainly believe that the use of Scoop.it would have helped me in my earlier years of study. I also believe it…will be helpful for students who are just starting tertiary studies and not just IT-related degrees but all degrees/courses that have essay writing aspects." Another of the students reflected that they needed to "wed through a lot of irrelevant information and many of the popular stories were not of a high quality."

Focus group

Six students volunteered to take part in the focus group, which elicited specific responses to questions of interest. The students' responses to a range of semi-structured interview questions were transcribed and content analysis was then undertaken in order to identify key themes. Motivation to engage with the Scoop.it assessment task was apparent in the student responses: "I want to play with it more and I've been thinking about doing other stuff with it…I wanted to play with the interface and make it more presentable and stuff. I enjoyed it." Another student said "I would come to uni and then go home to [Scoop.it] and see what other people had scooped…" In terms of information literacy, one of the survey respondents said that "I think [Scoop.it] for education is a great technology, especially if it were able to access peer-reviewed materials", while another student noted the currency of information Scoop.it provided: "Scoop.it gave me good ideas about where to look for information and what was new and emerging in the field."

Discussion

Documentary evidence

We analysed each of the 258 Scoop.it pages in order to assess whether or not the students were motivated to complete the assessment task and if they exhibited digital information literacy skills in their web-based annotated bibliographies. To complete the task, the students were required to curate a minimum of five pieces of content. 22 of the 258 students collected the minimum five pieces of content, whereas 236 students curated more items than was required, which suggests that they were motivated to put additional effort into the assessment task. In addition, 206 out of 258 students re-scooped content from other users, which was not a requirement of the assessment task. In order to do this, the user has to actively search for other Scoop.it pages on a similar topic area from which they can draw on and reuse (re-scoop) content for their own pages. Given that 79% of students re-scooped content, despite not having to do so, suggests that students were engaged with the platform and motivated to share content with others who had similar interests. This supports previous research which found that social software tools give learners a greater sense of agency by allowing them to engage in a global community where knowledge is exchanged and students assume an active role in the learning experience (McLoughlin & Lee, 2010). The results of this study suggest that the opportunity to showcase one's work to the community compelled students to invest greater effort in the learning task and to take ownership of their Scoop.it pages, which were accessible to the wider public.

Universities have a degree of responsibility to develop digitally literate graduates in accordance with student expectations and the demands of employers. We analysed the students' annotated bibliographies in order to identify whether or not they exhibited digital information literacy skills. While some students merely paraphrased what was in the articles they curated, other students attached value-judgments to the content, which were indicative of information literacy skills. One of the students noted that the information they had retrieved was from an "official product website thus making the information reliable [and] also fairly recent..." This suggests that the student was able to assess the value of content based on both the reliability and currency of information; two key indicators of digital information literacy. Another student observed that although one of his/her sources "has some older content on it… [It was a] great read and quite relevant." This student was similarly able to determine whether or not this digital item was credible based on the currency of the source and the relevance to his/her topic. In accordance with the digital information literacy skills outlined by the *Laboratory for Innovative Technology in Education*—the ability to effectively analyse and evaluate evidence; to analyse and evaluate alternate points of view; to synthesise and make connections between information and arguments; and to reflect critically, interpret and draw conclusions based on analysis—the majority of students demonstrated their ability to access and utilise quality sources, based on the relevance, currency and credibility of the information.

Survey Questionnaire

The quantitative and qualitative results of the non-compulsory survey (n=84) suggest that the integration of the digital curation tool Scoop.it into the curriculum was successful at engaging this cohort of students. 84% of survey respondents checked their Scoop.it accounts between one and three times per week over the four week period. The students were only required to publish five pieces of content, which they could have done in a single instance of logging into their account. As such, given that 84% continued to log in to their accounts for the duration of the assessment task suggests that they enjoyed using the platform and were motivated to use it even after they had achieved the minimum criteria outlined in the assignment. 63 students, or 75%, enjoyed using Scoop.it and 55 students (65.5%) said that they were motivated to use Scoop.it for the assessment task. The survey respondents who expressed a desire to use Scoop.it in another situation further support the conclusion that the students were motivated by the digital curation activity. 58 students (69%) said that they would take another course with a Scoop.it component and 53 students (63%) would use Scoop.it in another situation. In contrast, only 9 and 16 students respectively said that they would not use Scoop.it in alternative situation. This was supported by the open-ended survey responses with students reporting that Scoop.it made the assessment task "enjoyable rather than just plain boring" and that it compelled them to go "off on a tangent looking at related topics." The efficacy of Scoop.it was found to be high with 59.5% of students saying that it enhanced their learning experience and 69% indicating that the primary benefit of Scoop.it was engaging with his/her topic. The assessment task was also successful, although less so, at helping students clarify their career goals. 57% of students indicated that Scoop.it helped them to discover and determine the area of ICT they were interested in pursuing in their careers.

Scoop.it was a valuable addition to the learning experience, which motivated the students to engage with their essay topic and invest greater effort in the assessment task. The results also suggest that Scoop.it could potentially be used to cultivate digital information literacy skills among higher education students. 53% of survey respondents said that the primary benefit of using Scoop.it was learning how to assess the value of web-based content. In addition, 49 students (58%) agreed that as a result of using Scoop.it they feel able to organise ideas and information, whereas only 12 students disagreed and 23 were undecided. Moreover, 44 students (52%) were confident in their ability to use web-based content in their assignments and 41 students (48%) felt able to cite this content in their essays. One of the students noted that while Scoop.it did not help him/her to determine the credibility of content, as he/she had had years of tertiary experience, "I certainly believe that the use of Scoop.it would have helped me in my earlier years of study. I also believe it…will be helpful for students who are just starting tertiary studies and not just IT-related degrees but all degrees/courses that have essay writing aspects." However, 14 (16.5%) and 20 students (24%) respectively remained unsure of how to utilise digital content for writing tasks and how to reference these materials. This suggests that while Scoop.it may have enabled some students (43%) to make judgments about the value of web-based content, many students are either unaware of how to determine whether or not a digital source is credible or are reluctant to use these resources because of institutional requirements for peer-reviewed sources. It is worth noting that although the students collected at least five pieces of digital content for their Scoop.it pages, they were unable to cite these in their essays as peer-reviewed resources were mandatory. The inability to draw on the content that the students curated was raised as a potential drawback of the Scoop.it task: "None of the sources were peer-reviewed on Scoop.it yet we were apparently meant to only use peer-reviewed sources for the essay." Moreover, this research assessed students' perceptions of whether or not Scoop.it had assisted their information literacy skills but it did not actually measure them. In future iterations of this study, it would be worthwhile to test whether or not the Scoop.it task contributed to an improvement in the students' digital information literacy skills by getting the students to complete a literacy skills test both prior to and after the Scoop.it assessment task.

Focus group

The focus group discussions were broadly consistent with the qualitative data from the survey. The results suggest that the students' were motivated by the Scoop.it task to the extent that they were willing to invest greater effort into the completion of the assignment. Rather than simply satisfying the minimum criteria of the task (collecting five pieces of digital content), the students wanted to make their Scoop.it pages presentable and utilise the additional functionality of the platform: "I want to play with it more and I've been thinking about doing other stuff with it…I wanted to play with the interface and make it more presentable and stuff. I enjoyed it." The inclusion of the Scoop.it component into the curriculum also extended learning beyond the classroom and encouraged students to co-create knowledge with both their classmates and the wider community: "I would come to uni and then go home to [Scoop.it] and see what other people had scooped…" While the responses to the Scoop.it task were overwhelmingly positive, a disjunction between the students' desire to utilise digital content in their essays and institutional requirements to use peer-reviewed sources was apparent, with one student reporting that the tool would be invaluable for education, "especially if it were able to access peer-reviewed materials."

Conclusion

This study explored the potential of the digital curation platform Scoop.it as a tool for both facilitating engaging learning experiences and cultivating digital information literacy skills among higher education students. The results of the project indicate that using Scoop.it to curate a web page relating to interesting, cutting-edge technology was an effective engagement strategy. Its potential as a tool for cultivating students' digital information literacy skills was, however, less apparent.

The collection of data in this project involved three separate methods; analysis of the students' Scoop.it pages, a survey questionnaire and focus group interviews. The results suggest that the students were motivated to engage with the assessment task due to the outward-facing nature of the Scoop.it platform. The knowledge that their Scoop.it pages were openly accessible compelled the students to invest greater effort into the task and high results were thus achieved. The students openly reported that they enjoyed the Scoop.it task more than an essay and indicated a desire to use Scoop.it in other situations. The potential of Scoop.it as a tool for cultivating digital information literacy skills among higher education students is, however, less apparent and further research in this area is required. While the majority of students exhibited the signs of analysis and criticality that are indicative of digital information literacy skills, others reported difficulty determining the value and credibility of web-based content. Universities therefore have an obligation to provide students with opportunities to engage with digital technologies and utilise digital resources. Higher education students need to be able to judge the validity and reliability of information they find online; not just the peer-reviewed content that has been institutionally approved and is available in the library. While institutions continue to deny the appropriation of web-based resources, students' ability to find, analyse, and critically evaluate online information will remain unchanged and core competencies, such as digital information literacy, will inevitably fall by the wayside.

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The Digital Book in Higher Education: Beyond the Horseless Carriage

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This paper deals with the evolution of the book in the context of higher education. Digital books, or ebooks, need not be restricted to duplication of the printed page on a tablet device. As higher education embraces online learning, the tablet-based offerings from educational publishers will increasingly incorporate a variety of cloud-based learning activities and resources. These next-generation ebooks and etextbooks will look more like mobile apps than books. They will need to exchange data with a growing list of educational systems for student management, lesson planning, record keeping, learning analytics, assignment scheduling, massive open online course (MOOC) platforms, and so on. The Actionable Data Book project is a research and development effort undertaken this year to determine how to implement the added functionality required of educational ebooks in a way that will allow them to plug-and-play with other systems.

Keywords: Educational technology, ebook, mobile learning, future of higher education.

Introduction

For the last thirty years, computing technologies have enabled transformative and innovative ways of creating, compiling, and disseminating knowledge (Arenas, 2012). Today, these various technologies are widely accepted as part of the paraphernalia of any form of education at all levels (Arenas, Richards, & Barr, 2013). Economic, demographic, and social realities are causing academics, parents, and policy makers the world over to re-examine the purpose and process of higher education. Technology is now being used to expand our educational offerings and to explore alternative ways to achieve society's educational goals (Barr, Richards, & Robson, 2013). In that regard, however, it is impossible to predict the level of influence these technologies might have in supporting the learning process and teaching practices of the future. We may only speculate or imagine it on the basis of the lessons learned from the past and current practices and trends.

Recent reports by the New Media Consortium (NMC), part of a major longitudinal research effort, offers some insight into these trends and the challenges awaiting us (Johnson et al., 2012; Johnson et al., 2013). At the top of the list of future trends that will impact higher education, according to NMC, is the expectation of being able to work, learn, and study anything, anywhere, at anytime. Within this new learning ecosystem, it will not be uncommon to have the education paradigm dominated by the blend of learning models including online, hybrid and collaborative models, and the push for more challenged-based and active learning. Along with these trends, there will be the emergence of new scholarly forms of content creation, publishing, researching and content dissemination that will present significant challenges for libraries and university collections, how scholarship is documented, and the business models to support these activities (Johnson et al., 2012; Johnson et al. 2013).The question for publishers and content creators is how to respond to this onslaught of challenges engendered by the new mobile learning ecosystem. More specifically how will publishers' digital offerings evolve as ebooks and etexbooks get used in educational institutions?

This concise paper has been designed to answer this question. Using the NMC findings as the backdrop, we attempt to speculate and reflect on the actualisation of a global platform for connected learning called the Actionable Data Book (ADBook): a specialised ebook, grounded in learning and teaching principles, based on open standards, tailored to support science, technology, engineering and mathematics (STEM) education and that will support learner's accessibility and usage preferences (IEEE ADB Project, 2013). Our reflection borrows on the well-known horseless carriage metaphor: ebooks soon will no more resemble their paper namesakes than cars resembled their horse-drawn predecessors.

Background

When Amazon introduced its Kindle™ tablet in late 2007, it was the beginning of a new era in reading: ebooks, newspapers, magazines and all forms of digital media. The technology continues to advance and to improve the reading experience of the users. Taking the ebook as an example and given the scholarly importance of this form of digital media in higher education, such e-readers' improvements do not comprise a significant qualitative change in the processes of learning and teaching. In terms of emerging learning technologies, there is a need to rethink the affordances of what we know as an ebook. The situation is similar to the horseless carriage metaphor where initially people's mind was set to think about the automobile as a carriage without a horse. As put by Henry Ford, the American industrialist founder of the Ford Motor Company: "If I had asked people what they wanted, they would have said faster horses". But the car is much more than a horseless carriage and the metaphor soon tired, as people began to see possibilities invisible in the horse-drawn era.

For the purposes of this discussion, a book is produced by a publisher who manages experts in specific disciplines, digital rights, editors, peer-reviewers, graphic designers, and others to produce a product with mass appeal. In this context, there might be three ways of conceptualising an ebook: the digital version of a hard copy print book. First, ebook may be defined as the digital version of a book viewed on a tablet like the Kindle™ or iPad™. In this case, the ebook simply mirrors the functionality of a traditional book with the value added of cost effectiveness, easiness to buy and update, and mass portability (you can have a whole library with you at all times) amongst others. Secondly, an ebook may be considered as a digital book with some kind of additional functionality like interactivity, term searching, and links to more information and related web sites. Thirdly, ebook may be a digital offering from a publisher that may not reassemble a book at all.

The authors believe that the ebook will soon take the latter form: something more like a mobile app than a sequence of pages with a table of contents and an index. We are actively working with our IEEE (Institute of Electrical and Electronics Engineers) colleagues on data interoperability standards that will allow ebooks to become the learner's personal window into the publisher's cloud-based learning offerings. Ebooks will be one part of a growing ecosystem of different kinds of products and services for teachers, students and administrators. As a result, authors and publishers must think about new functionality, for example:

- Integrating and exchanging data with institutional learning management systems (LMSs), online activities, learning analytics products, etc.
- Using the new Experience Application Program Interface (xAPI) activity stream protocol to update the learner's status data in a learning record store, which in turn is monitored by, for example, a dashboard app used by her teacher, e.g. using the xAPI protocol.
- Monitoring the status of a device or instrument that the student is learning to use.
- Gathering relevant background data about the student from LMSs and other systems.
- Supporting teachers and learners who work and learn in multiple organisations.
- Linking to workplace performance systems, i.e. taking the textbook to work.
- Allowing publishers to link ebook content to sophisticated online offerings: immersive simulation environments for practice and assessment; multi-player games; adaptive testing systems; robo-graders; intelligent tutoring systems; etc.
- Allowing instructors to assign, monitor, and participate in ebook-based activities in real time.
- Giving training organizations better ways of evaluating training materials and of keeping them up to date.

This model of ebooks is defined by the learning needs and demands of the future students and the teachers and institutions that help them learn. We refer to this enhanced model as the Actionable Data Book, or ADBook for short.

A Global Platform for Connected Learning

The ADBook project grew out of a paper presented at the IEEE Global Humanitarian Technology Conference in 2011 that discussed a broadly applicable framework for building educational applications that combined field data collection and data visualization (Richards & Barr, 2011). In January 2013, the suggestions in the paper were incorporated in the ADBook project. The goal of this one-year research and development collaboration is to define and demonstrate an actionable data book consisting of a specialised ebook based on open standards that is tailored to support STEM education and supports learner accessibility and usage preferences. The project's requirements for the actionable data book are that it must be able to:

- Use camera and Global Positioning System (GPS) data from a learner's mobile platform.
- Use measurements from local lab equipment.
- Exchange results of learning interactions with cloud-based LMSs, analytics engines, and other applications.
- Retrieve content from cloud-based sources (e.g. content repositories).
- Store and retrieve student history and preferences in the cloud.

Operationally, the project is hosted by Industry Connections, an IEEE Standards Association program that facilitates the early exploration of potential interoperability solutions (Richards, 2012). Participation is free and open to interested parties. The IEEE ADBook project may continue past the initial year's charter, depending upon success. Technologically, the project anticipates the global availability of a class of mobile devices comprising smart phones and connected tablets and explores the premise that those devices, in conjunction with a new content format, may provide the first truly global platform for connected learning. The format in question is EPUB3 (Garrish, 2011; IDPF, 2013a), a new ebook format defined by the International Digital Publishing Forum (IDPF, 2013b).

Ebooks have emerged as a mass-market commercial success within the past few years. To date, as suggested above, ebooks have only replicated the static content of printed books in a digital medium, but EPUB3 introduces interactivity to ebooks by embracing JavaScript and the Hyper Text Markup Language version 5 (HTML5) standards for web page content. These characteristics make EPUB3 an attractive foundation for a more fully featured learning delivery platform. EPUB3 offers a complete solution for portable, interactive, connected content, and it is relatively simple to map the requirements for an interactive learning activity onto baseline EPUB3 capabilities. Since EPUB3 is a general-purpose technology with broad appeal outside of the education industry, it is more likely than education-specific standards to be widely adopted, to have adequate support, and to have a multi-decade life span.

Although most of the technology used by the ADBook project was developed for commercial purposes in the developed world, its application to learning was originally inspired by the desire to enable students in remote locations to collect field data and share their data and culture with other students in the world. The first use case to which it will be applied is the construction of an enhanced, interactive guidebook for the new UNESCO World Heritage site on Bali (Lansing & Watson, 2012a; Lansing & Watson, 2012b; UNESCO, 2012).

The UNESCO site covers a significant geographical area encompassing 21 communities engaged in rice production and following traditional spiritual practices. This has resulted in an enormous challenge: How does one design an interactive guidebook that promotes the conservation and preservation of the site while meeting the needs of the people who live there, the international team developing and maintaining the site, and tourists from all over the world with varying degrees of cultural sensitivity? The ADBook project aims to help meet these requirements by developing onsite learning activities and guides that adapt to the local geography and culture as well as to those of the user's culture. The project will also support remote connectivity, allowing students to vicariously experience the site from anywhere on the planet.

The UNESCO site is just an example of the affordances of the ADBook. As noted above, the project is intended to support generic STEM education as well as learner accessibility and usage preferences. In this respect, the challenge for the ADBook is to be regarded by the learning and teaching community as an improved platform that supports modern approaches to meaningful and transformative learning.

Imagining the Future with the ADBook

In terms of STEM education, the ADBook is expected to tap into newly emerging product categories. Some will be engendered by societal requirements and others by advances in educational technology. For example, students and teachers are increasingly connected with multiple institutions at the same time (Newbaker, 2012), and many of the more innovative learning technologies are typically used outside standard classroom practice. This may require tracking of rosters, assignments, progress, and grades across multiple institutions and multiple online learning systems. Students' history and preferences will be maintained in an external "learner model" (Durlach & Ray, 2011; Sottilare, 2013; Woolf, 2009) or e-portfolio. This student-controlled data locker can be updated and queried by multiple adaptive learning systems. The natural evolution of the e-portfolio will be a personal learning record store that is:

- securely controlled by the learner;
- portable as the learner works with multiple schools, teachers, tutors, and publishers over the years; and
- contains the learner's preferences and his validated and certified formal and informal learning history.

This evolution of the learner's history records would parallel the recent evolution of Electronic Health Records and, if implemented on a global scale, would spawn a plethora of products, ranging from tools to manage learning records to learning activities that analyse this extensive background data to deliver more personalised, culturally relevant, and educationally effective learning experiences. Similarly, advances in cognitive science, computer science, and information technology are also creating both requirements and affordances for new product categories. Just as the underlying technological components of expert systems have now found their way into hundreds of products from rice cookers to mobile phones, we anticipate that the artificial intelligence (AI) components of today's intelligent tutoring systems will work their way into a wide range of learning products. The same is true for automated language understanding (Robson & Ray, 2012), automated grading (Valenti et al., 2003), affect detection (Calvo & D'Mello, 2010; Hussain et al., 2011), gesture and sketch recognition (Valentine et al., 2012; Weinland et al., 2011; Yin et al., 2010); and forms of social media that enable students to collaborate with each other and with adults (e.g. "granny tutors") (Doctorow, 2011).

Conclusion

There are many forces re-shaping higher education, resulting in serious questions about who, what, and why we teach. Whatever future faculty teach, it is likely that much of that teaching will be done differently. We are at the beginning of a sea change in education at all levels. Eventually, through innovation, investment, trial and error, educational technologies like the ADBook will evolve to help teachers teach and students learn more thoroughly, less expensively, more conveniently, more broadly, more efficiently, and more effectively.

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Learning Analytics in Higher Education: A Summary of Tools and Approaches

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Higher education institutions recently have been drawing on methods from learning analytics to make decisions about learners' academic progress, predictions about future performance and to recognise potential issues. As the use of learning analytics in higher education is a relatively new area of practice and research, the intent of this paper is to provide an overview of learning analytics including a summary of some exemplar tools. Finally we conclude the paper with a discussion on challenges and ethical issues.

Keywords: Learning analytics, higher education, learner, tools, big data and stakeholders.

Introduction

There is increasing competition in the higher education (HE) sector to adopt practices to ensure organisational success at all levels by addressing questions about educating and retaining a larger and more diverse student population, admissions, fund raising and operational efficiency (van Barneveld, Arnold, & Campbell, 2012). In this competitive environment, Higher education institutions (HEIs) have entered the era of 'big data' and are collecting large volumes of data relating to their learners and the educational process. These vast amounts of data are stored in the student information systems (SIS); including learner interactions with various educational technologies such as learning/course management systems (LMS/CMS); and in various databases such as admissions files, library records and other systems (Tair & El-Halees, 2012). The extraction of the data derived from these technologies are potentially accessible for data mining, analysis (and interpretation) and has captured the attention of HE administrators, academics, researchers and government agencies.

There is a plethora of terms and definitions used for analytics in the academic domain. Examples include business analytics, educational data mining, academic analytics, learning analytics (LA), predictive analytics or action analytics. Some of these terms are conceptual (what it is) while others are more functional (what it does). However, this is basically due to the observation that these new forms of analytics can begin to address some of the concerns challenging the HE sector such as improving retention, addressing curriculum standards, increasing accountability, measuring teaching quality, graduation rates and employment placement (Arnold & Pistilli, 2012; Dawson, 2011; Kovacic, 2012). Therefore, in line with the conceptual framework of analytics in HE by van Barneveld et al., (2012), we can say that LA in the academic domain is focused specifically on learners, learning processes and their learning behaviours (Greller & Drachsler, 2012), gathering data from LMS and SIS in order to establish indicators of concepts such as knowledge construction, creativity, self-directed learning, sense of community, and assessing academic progress based on assessment and structured activities (Bienkowski, Feng, & Means, 2012; Dawson, 2011). This can be achieved by: predicting learners' performance; suggesting relevant learning resources; increased reflection and awareness on the part of the learner; detection of undesirable learning behaviours; and detecting emotional states such as dullness or frustration of the learner.

The 2013 horizon report identified LA as a key future trend in technology enhanced learning and teaching (Johnson et al., 2013). As an emerging field, the process of LA uses the data associated with a learner's interactions to draw out pedagogical patterns to inform decisions and evaluations (Arnold & Pistilli, 2012; Gammell, Allen, & Banach, 2012; Long & Siemens, 2011; van Barneveld et al., 2012). A key motivation for LA is to improve internal institutional cross collaboration and setting an agenda for the larger learning and teaching community (via socialisation, pedagogy and technology). Learning analytics is still in its infancy; however its short life has produced numerous conceptualisations. In an effort to add clarity to this landscape, the aim of this paper is to compile a summary of some exemplar tools based on four dimensions of LA (input, stakeholders, goals and techniques). In the following section we present five exemplary tools and their brief comparison. The paper concludes with a discussion on challenges and ethical issues.

Exemplar Tools and Approaches

To comply with the space constraints, we are describing only four tools. The following university-specific tools were chosen because they illustrate a combination of alternative purposes and goals of LA. The bigger objective behind all the tools is to improve student success and retention and to understand reasons for student disengagement and attrition. All tools were developed and implemented at Australian universities. Some of the tools are not publically available and most others only seem to work within very specific environments, although they may have been designed in a more general spirit.

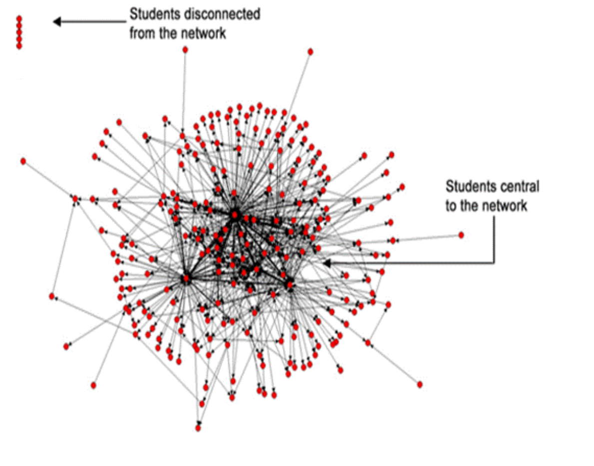

Figure 1: The SNAPP Tool

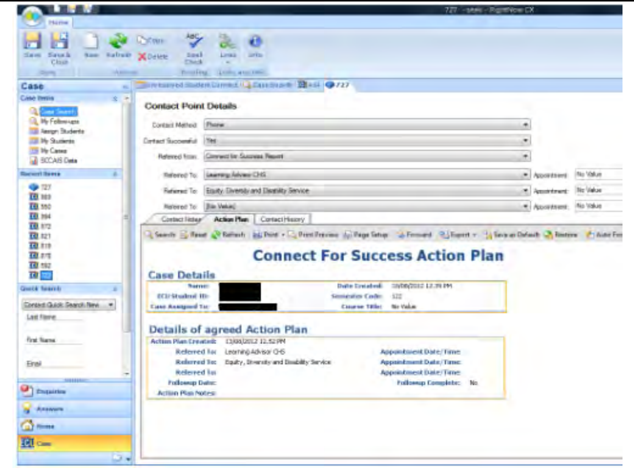

Figure 2: The C4S Tool

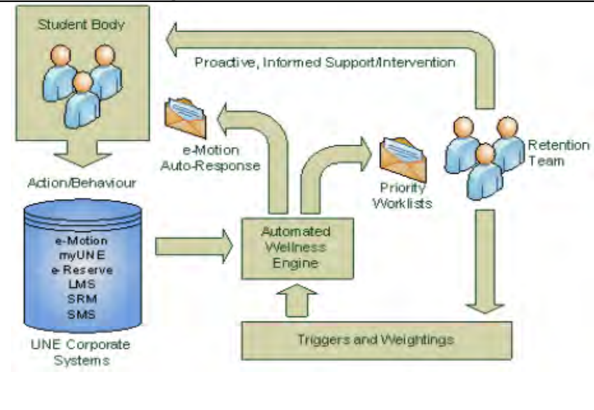

Figure 3: The AWE Tool

Figure 4: The PASS Tool

University of Wollongong (UOW)-The Social Networks Adapting Pedagogical Practice (SNAPP)

The SNAPP tool generates visual representations (social network diagrams) of user interactions, activity and patterns of behaviour on discussion forum posts and replies. The visual mapping illustrates the users' level of engagement and activity with the aim of identifying learners who are at risk of underperforming due to lower levels of participation in comparison to other learners (Figure 1). The tool retrieves data from, and generates reports based on, learner interactions from commercial (blackboard) and open-sourced (Moodle) LMS including log-in frequency, dwell time and number of downloads (Bakharia & Dawson, 2011).

Edith Cowan University (ECU)-Connect for Success (C4S)

The C4S is a proactive, university-wide and fully automated system based on enrolment data and pre-determined triggers (demographic data, behavioural data, student survey and self-report) will be supplemented with triggers fed from the other data sources (Blackboard, RightNow, academic referrals, mid semester grades). This early warning tool (Figure 2) seeks to improve learner success and by implication, their retention and graduation rates. The C4S automatically flag learners who are likely to require extra support to complete their studies. Once students have been identified, they will be referred onto the appropriate services within the university by the C4S team. In addition to daily reports, a series of consolidated reports will be sent to key support services and faculties within the university (Jackson & Read, 2012).

University of New England (UNE)-Automated Wellness Engine (AWE)

The AWE is an early alert engine designed and built to enhance learner engagement and retention at UNE (Figure 3). The AWE is based on the successful Emoticons identification activity embedded in the online UNE student portal (myUNE) and other data in different university systems (e-Motion, e-reserve, LMS, SRM-student relationship management, SMS-student management system, unit discontinuation poll and the Vibe) related to learners interactions with the university and their teachers, use of facilities and their responsiveness to deadlines. The AWE's, 'evidence-based system of retention' helps to identify high-risk learners who may be struggling or experiencing disengagement from their courses (Leece & Hale, 2009). Based on the indicators, the AWE generates daily or weekly wellness reports which details reasons for withdrawal and wellness-happiness ratings within individual schools and courses.

Open University Australia (OUA) - Personalised Adaptive Study Success (PASS)

In a Criterion Conference on Improving Student Retention and Success held at Sydney dated 27 June 2013, Dr Dirk Ifenthaler from OUA presented the PASS, an early alert tool designed and built to enhance learner engagement and retention in an online learning environment (Figure 4). Based on individual characteristics, social web, curriculum and physical data drawn from a number of systems (My study center-study buddies, smart thinking-online study support, discussion forums, social media pages, student success hub and others) in an online learning environment are integrated, processed and analysed by a learning analytics engine, personalisation and adaption engine and reporting engine helps to identify high-risk students who may be struggling or experiencing disengagement. Based on the various indicators used, the PASS generates visual signals, performance levels, self-assessment, predictive course mastery, highlight social interaction, recommends content and activities and provides a personalised environment.

Summary of Conceptual Analysis of Exemplar Learning Analytics Tools

The following Table 1 provides a summary of the tools based on what kind of data the tool are using for analysis (input), who is targeted by the analysis (stakeholders-academic institution, department and learner), the purpose of the analysis (goal), and how the tool performs analysis of the collected data (techniques).

Table 1: Summary of Learning Analytics Tools

	SNAPP	C4S	AWE	PASS
Input(s)				
Student information system (SIS)		X	X	X
Learning/course management system		X	X	X
Grade book				
Discussion forums	X		X	X
Social media pages			X	X
University specific systems		X	X	X
Stakeholder(s)				
Institution		X	X	
Department			X	X
Learner	X	X	X	X
Goal(s)				

Monitoring	X	X	X	X
Analysis	X	X	X	X
Prediction	X	X	X	X
Intervention	X	X	X	X
Adaptation		X	X	X
Tutoring/Mentoring				X
Assessment				X
Feedback				X
Personalisation		X	X	X
Recommendation		X	X	X
Reflection				X
Technique(s) used				
Learning analytics (LA)	X	X	X	X
Social network analysis (SNA)	X			X
Visualisation	X	X	X	X
Statistics	X	X	X	X
Emotional intelligence (EI)			X	

Discussion and Conclusion

The aim of our comparison is to expand our understanding of LA in the HE sector. Table 1 summarises the exemplar tools based on four dimensions of LA (input, stakeholders, goals and techniques used) to demonstrate how data residing in different HEI systems can track many aspects of learner performance and behaviour to develop new tools, such as intelligent early warning systems to predict learner performance. Eventually, such tools can provide information to HE administrators and learners to facilitate their decision making.

Recently, Willis and his colleagues suggested a thorough list that exemplifies the types of questions institutions must address when using big data. According to Willis, Campbell, and Pistilli (2013), some examples could be:

- Does the college administration let learners know their academic behaviours are being tracked?
- What and how much information should be provided to the learners?
- How much information does the institution give instructors (faculty members)?
- Does the institution provide a calculated probability of academic success?
- How should the instructors react to the data?
- Should the instructor contact the learner?
- Will the data influence perceptions of the learner and the grading of assignments?
- How many resources should the institution invest in learners who are unlikely to succeed in a course?
- What obligation does the learner have to seek assistance?

As a final comment, various open issues need to be addressed before institutions can make use of learner data. Issues for LA fall into the following broad, often overlapping categories: the location and interpretation of data; informed consent and privacy of data; and the management and classification of data. To address some of these issues, Slade and Prinsloo (July, 2013) propose an ethical framework for HEI to address the ethical issues and challenges in LA which in turn can help to increase the quality and effectiveness of learning and teaching.

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Imagining the Enculturation of Online Education

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Participation in popular sub-cultures developed through new technologies involves learning rules and protocols for participation that are cross-cultural and cross-lingual. New multimedia games create and incorporate international rituals or protocols for a group of consumers. The development of communication technology has seen increasing numbers of these multi-media games emerging. These multi-media games involve full immersion into a created world.

This paper discusses the ways in which learning is seen as active not passive absorption of information. As Combs (2002) states with the internationalisation and decline of a common religion and culture students need to communicate in ritualistic and symbolic acts with one another. In order to participate in the popular cultures children must learn social skills and develop a common culture, building their social and communicative competencies. According to Tobin (2003) university programmes have potential to piggyback on the phenomena providing a ‘common culture’ for students to learn in.

Keywords: multi-media games, world building, tertiary education

Introduction

This paper examines children’s and young adult’s multi-media subcultures and ways these elements could be transferred to the tertiary sector for improved and more relevant learning for students. Firstly looking at the way in which these sub-cultures have developed as both technology and the marketing to children as consumers has increased. Secondly, discussing the narrative scripts that are used to develop the multimedia subcultures for children. Then discussing the use of narrative as the shared understanding that gives all participants from all cultures and languages the ability to participate with one another. Finally considering the rituals, value sets and shared language embedded within these scripts and how the narrative allows glocalisation (Jenkins, 2006) of multimedia subculture. This means that it is portable and can be participated in locally as well as globally which is ideal for a university environment.

Narrative scripts of sub-cultures

According to Nielsen (2009) children in the ‘tween age group are engrossed in activities enabled by the use of digital media. It is not the digital tools that they use, as throughout the literature (Papert, 2003; West, 2006) boys within this age group demonstrate consistent lack of interest in using computers for educational activities at school but rather the worlds they are becoming involved in that fascinate them. Allison (2008) discusses the participation within the development of the narrative as they play as being appealing to children, in particular this age group. She asserts that these environments allow them to become involved, take on a character and be part of the story as it unfolds. From ancient times stories were the main form of education. Storytelling for education purposes lost popularity as education took a more Protestant philosophy and became based learning on scientific principles. However as knowledge bases have increased and technology explosion, globalism and the multiple literacies needed to participate within this world the use of storytelling as an educational tool is becoming accepted once again.

The evolution of the viewer being seen as audience to public in media has seen the viewer take on a larger role in the development of the product. Vygotsy's (1987) theory of social constructivism is now popular in both media studies and education. Viewing and learning are now both seen as an activity not passive absorption of information as demonstrated by Buckingham and Sefton-Green (2001). For learning to be effective children must also learn social skills and develop a common culture, building their social and communicative competencies. These competencies include skills in negotiation, self-confidence and tolerance for others. According to Tobin (2003) programmes such as Pokemon encourage these skills, both by modelling and providing a 'common culture' for children to rehearse in. Combs (2002) stated that with the internationalisation and decline of a common religion and culture it is necessary for children to communicate in ritualistic and symbolic acts with one another.

Identity is a way in which a product, person or group can be identified as belonging to a certain group, use or value. Identity is both internal and external. The internal identity is often subversive and subconscious and the external identity is often developed in a purposeful way so as others perceive the intended message and values. Corrigan states about the way in which fashion has been used to identify people throughout history:
"Young people are very adept at the symbolic work of developing their own styles and reading off and decoding the dress styles of others and relating them to the musical, political and social orientations"(1997:28). This can be seen in the development of tween's online social networking sites and the ways in which they trial and develop personal identity through the use of multimedia (Jenkins, 2013).

Brown (1995:138) discusses how post-modern identities reflect a preoccupation with hyper reality, pastiche, liminality, carnivalesque, heterogeneity, spectacle, ambiguity, nostalgia, hybridity and fragmentation. This can be seen as the reversal of traditional identity development or a reversal of the control of the state over a person's identity. In traditional societies these places were outside of the normal roles and functions of the society, some taboo and others as normal rituals of the society. However they were places where people were able to create their own identity and try out different identities. Brown suggests that this has become the norm- people are living in these places as part of everyday life. Technology development, in particular television (Kline; 1993), has been blamed for the mediatisation of consumption, which has in turn enabled the market to develop this environment.

Cultural knowledge/learning

The knowledge of a culture was traditionally handed down from one generation to another through artefacts, learned ceremonies, language and shared narratives that gave demonstrations of the values underpinning the culture (Besley, 2003). The consumption patterns of the culture were often tied to ritual and narrative, with particular members of the cultures having set roles. Kenway and Bullen (2001) discuss the ways in which consumption has always had a role in culture and has been taught to following generations. Consumption rituals and practices have been used frequently in anthropology to give an insight into the shared values of the culture

The views of what constitutes culture and the geographical spaces of culture differ between eras and philosophies. The development of communications technologies has allowed new spaces and tools for developing culture as well as fears for and of other cultures. For the purpose of this paper culture is viewed *as a conceptual space in which the notion of "the learner" is constructed, experienced and struggled over*. As Giroux states with regards to children "culture is the primary terrain that adults exercise power over children in and that it is only by questioning the specific cultural formations and contexts in which childhood is organised, learned and lived that educators can understand and challenge the way in which cultural practices establish social relations that shape children's experiences" (2000: 4). This view of culture is powerful and revealing as it can be applied to the many conceptualisations of culture as well as the international nature and transference of culture and cultural artefacts.

Goldstein-Gidoni (2005) discusses the research she has done on the transference of Japanese culture to Israel. She looks from a critical theorist point of view at the way in which a culture, in this case the Japanese culture, can be packaged and transported in a 'global' world. She identifies with 'globalisation' as not being about Americanising the world but allowing cultures to define themselves and make themselves transportable to other areas. Goldstein-Gidoni (2005) uses her case study to exemplify the process of 'global cosmopolitanism'. In order to demonstrate this process she traces the history of how and why Japan have packaged their culture. Japan has identified the differences they have from Western culture and associated their culture with aspects of the Western culture that they found tasteful. The Japanese have then purposely and strategically perpetuated this stereotype to the world, although it does not match the reality of living in modern Japan. The author then discusses the arts they have chosen to represent their traditional culture (flower arranging, painting, calligraphy, cooking, paper folding). By representing Japan in this way they are able to develop and pass on their cultural arts by having people from foreign countries learning and teaching in their own countries. The traditional Japanese arts may have died out had they not been taught to other cultures.

Jansson (2002) discusses post-modern culture in its most basic elements; products, communities and practices and discusses that through hermeneutic signification and interpretation meaning is created. This leads to the importance of symbolism in culture and he argues that consuming requires media to make it symbolic. Jansson also illustrates the emergence of image culture through three complimentary processes: culturalisation, mediatisation and simulation. He argues that material objects actually have a greater non-material component than material component in post-modern culture and therefore consumers need to have an understanding of the meaning of things before they will purchase them. He also describes the process by which people create their own worlds through their patterns of consumption these worlds give people a sense of time and place and this he believes is defined by the media. He links this mediatisation of people's 'worlds' to Anderson's 'imagined communities' theory and explains how in post-modern society people can belong to a number of communities.

The development of communication media has enabled mediatised cultural learning (Jansson, 2002). This means that a person can develop an understanding of aspects of their culture without engaging in dialogue with other members of the culture but through engaging with the communications tools. Cultures can be developed without face-to-face contact. Values can be learned through commercial companies using advertisements or developing dominant narratives in movies and television series (Martens, Southerton and Scott, 2004). Shared cultural knowledge is created through the use of newspapers and news broadcasts on radio and television. Certain views are given credence and dominance by their ability to have their comments and interests broadcast. Giroux (2000) examines in detail specific cases where mediatised cultural learning allows different groups to have the power to shape the views of the culture.

Jansson (2002) discusses how the relationship between encoder (the person or group that creates the information/entertainment) and decoder (the person who reads or views the information or entertainment) is blurred in modern communications technologies using specific examples *The Runner, Canadian Urban Juice and Soda company, Swedish TV channel TV3 and Walt Disney.* He applies the theory of image culture to these companies and explains how the semiotics of consumption are utilised by these corporations. Using these examples he builds a picture of how image culture is developed and what works when applied to global cultures. He discusses this with specific reference to the links between the interrelated texts of advertising and products and the public and how the interpretations of texts are changed to fit social actors.

Conclusion

So how can these theories be applied to tertiary education? Universities are increasingly attracting a global cohort of student and staff. Universities are required to appeal to students from different cultures and backgrounds and classes are therefore becoming more culturally diverse. This creates the need for a “shared space and group identity” so that learning is owned by and more relevant to all students. Courses of study are increasingly building online components and these components are increasingly becoming multi-modal. Jansson’s theory of image culture can be applied to courses of study using the three complimentary processes: culturalisation, mediatisation and simulation. This would extend the reach of universities to attract a more diverse student base. Through applying image culture theory make the courses relevant to a more diverse students base and enable them to feel part of a community of like-minded people. To do this it is important to observe how we are placing and viewing “the learner” in the university community- are they an empty vessel absorbing knowledge or are they given agency to construct and develop their own understandings of the course? Finally before we can attract an international student base and really develop their learning we need to look at, as Japan have, what are we packaging as “Australian” to a global audience and whether this enabling Australian universities to be transportable to other cultures as an educational product.

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Five stages of online course design: Taking the grief out of converting courses for online delivery

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The burgeoning online delivery of higher education requires support and resourcing to be successfully implemented. In this paper, we report on the initial design and development of a professional learning module intended to guide academics when building quality online courses through a five-stage framework. The framework and resulting training module were developed in response to the growing demand on academics to convert their face-to-face courses to online offerings. This accelerating trend to move online often exceeds the capacity of allocated university course development resources (based locally or centrally as development units or specialised roles). It is for this reason a streamlined approach is needed to provide alternative support to academics that alleviates the pressure on these specialised support roles. The module developed also provides an example of how professional learning can be tailored to meet strategic university policies while delivering on quality products that align with everyday academic processes.

Keywords: Online Learning, Professional Development, Learning Design, Higher Education

Introduction

The design and development of online programs and courses in higher education is not a new phenomenon. With increased demand to attract and retain students through offering flexibility in study modes and with the advent of the Massively Open Online Course (MOOC) the imperative to move online is becoming more urgent. Building quality online courses requires not only technological expertise but for many new pedagogical expertise (Caplan & Graham, 2004) as these online learning models and frameworks have yet to be widely adopted by the academic community (Roby, Ashe, Singh, & Clark, 2012). In the last couple of decades universities have invested heavily in resourcing specialty units that were tasked with creating multimedia educational content in conjunction with the academics, usually on a limited project or fee-for-service basis. This model of resource development was possible when universities were concerned with boutique course development but is not financially viable to the large-scale course improvement model that many universities are experiencing now and into the future. Furthermore, as we move through the 21st century, one defined by rapidly advancing and ubiquitous digital technologies, it is now assumed that academics (and students) should be able to naturally incorporate these technologies into their teaching and learning practices (Koehler & Mishra, 2005). As such, many universities are scaling back their funding of these specialist units focused on high-end resource development and instead concentrating their investment on providing enterprise level applications such as Learning Management Systems to allow academics to deliver online courses. Therefore the challenge facing many universities now, and in the future, is how to provide academics with the professional learning necessary to acquire these new pedagogies and effectively use the technological tools provided.

Developing quality online courses and programs often requires a complete reconceptualisation of an academic's teaching and learning strategies (Bennett & Lockyer, 2004; Caplan & Graham, 2004; Garrison & Kanuka, 2004; Hanson, 2009; Macdonald & Poniatowska, 2011). It is for this reason it has become necessary for the development of a professional learning module that encompasses both the pedagogical and technological perspectives of the design process. This module will serve as a just-in-time resource to support the academics in the process of converting from a face-to-face delivery mode to an online one. It is intended that by giving the academics a strong pedagogical perspective on the curriculum design process that they will be able to make appropriate technological decisions when implementing the design. It is also envisioned that by completing this module that the conversations with the specialised development teams will be much more meaningful as many of the content and teaching activity decisions will have already been made. It is our experience that development projects conducted with specialty units often become costly or fail because academics are not given the time or the space to do the conceptual thinking required to make such radical shifts in their curriculum to make use of these specialist roles.

The challenge becomes: how does one breakdown and then reconceptualise this process of redesigning courses for an online environment and present it in a way that would be useful to an academic who has many other competing pressures and very little time to concentrate on the redesign process.

Designing the Online Course Design Framework

It has been acknowledged that academics generally do not take advantage of educational research (Price & Kirkwood, 2013) rather relying on personal experiences or their conversations with colleagues (Dondi, Mancinelli, & Moretti, 2006; Macdonald & Poniatowska, 2011; Price & Kirkwood, 2013; Spratt, Weaver, Maskill, & Kish, 2003) to improve their practices. As such the overall guiding principle in designing this professional learning module was to ground it in the theoretical frameworks that encompass quality online course design, while making it consumable for the average academic by providing practical examples from their colleagues to illustrate the theory in practice. The guiding pedagogical principles for the development of this module where underpinned by the three frameworks of Community of Inquiry (COI) (Garrison, Anderson, & Archer, 1999), Technological, Pedagogical, Content Knowledge (TPACK) (Mishra & Koehler, 2006) and the Goodyear (2005) pedagogical framework. The use of these three models is well documented in educational research on quality online course design (Anderson, 2008; Garrison & Kanuka, 2004; Koehler & Mishra, 2005; Rubin, Fernandes, & Avgerinou, 2012; Wiesenmayer, Kupczynski, & Ice, 2008).

Once the theoretical frameworks that would ground the modules were decided, the next task was to break down the process (and re-conceptualisation) that is required to build online courses into achievable steps. The main purpose of which was to direct academics away from the traditional concept of designing for the structured time periods of lectures and tutorials towards a more holistic design focusing on content and interactions. As such we defined five distinct, but ultimately interlinked, areas to stage the framework. These stages are Getting Started, Curriculum Design, Interaction Design, Assessment Design and Site Design.

Figure 1: Homepage image of the module site

The intention of each section of the framework is briefly outlined below:-
Getting Started
This area frames the process in the larger context of the university outlining relevant expectations, structures or processes that are to be adhered to during course development. By positioning the process in existing processes and workflows it creates a positive perception with the academics that this module and the design of their course is not an extra workload. It also serves to position the process within the support structures that are available to the academics; one of the greatest challenges for support roles (i.e. educational designers, multimedia developers) is that academics know that they exist to help.

Curriculum Design
Activities throughout this section help academics to design and review their course learning outcomes, consider content sequencing, articulate the purpose of the assessment plan, appraise what learning activities will be most appropriate and plan for a cycle of evaluation. This section touches briefly on theory, highlights good practice, and through the activities provides completed design plans that can be transferred directly into required university documentation such as course profiles.

Interaction Design
This is seen as one of the most crucial parts of the process to produce quality online courses (Finch & Jacobs, 2012). This area outlines the process of using the Community of Inquiry framework to reconceptualise courses as a series of content and student interactions to create the learning environment.

Assessment Design
This section briefly discusses the philosophy underlying the concept of assessment *for* learning, exploring the purpose and outcomes of formative and summative tasks that were initially discussed in the Interaction Design section. In the current higher education context, universities are looking to maximise outcomes through the potential of high enrolments in online courses so the size of the cohort and its affect on marking effort (and hence the sustainability of the task) should be explicitly considered in the course design.

Site Design
This is seen as one of the other crucial areas in the framework as this is often what is missing from online courses. This teaches the academics the importance of creating a teacher presence through elements of site design and the importance of instructional text in an online environment.

Early in the design process for this framework it was decided to make a clear distinction between the design of an online course and the teaching of an online course. However, during the creation of content for each stage it was found that this distinction can often blur so a sixth but separate stage, *Next Steps*, was added. This area briefly highlights where design factors of a course can affect how a course is eventually taught and serves as a lead in to the next professional learning module (to be developed), “Teaching Online Courses”.

Each section has been framed with simple question statements to help frame the work that is required to design online courses. The intention of which is to speak to the academics in a conversational tone, which allows the academics to see the process in their own terms and not as something external. While this module is pedagogical in nature the main ideas are illustrated through practical examples of the technologies in use provided from the academic’s context. Allowing the academics to internalise the theory and start seeing how the technologies can be used in practice, based on the learning activity ideas that they design. For this reason these modules are highly adaptable for any discipline or environment as the main content is provided through examples.

Each section also contains practical activities that scaffold the design process. These activities were designed to fit and explicitly link to the development of the course or unit outline, the documentation requirements of most universities. The purpose of which was to reduce the perception that designing an online course or more importantly, participating in this development module would be extra workload on the academics’ part. All activities are based on these requirements so that academics are not spending any extra time or energy in completing this module. It is this defining design factor that makes this module highly adaptable for any discipline or university to adapt to their own context.

Conclusion

The module was initially trialed, in a workshop format, with a small team of academics that have been tasked with developing a new online teacher-training program to begin delivery in 2014. Anecdotal feedback from this initial trial suggested that the team found the information very useful and that they would be returning to the content as they move further through the development of their individual courses. A pilot will be conducted with a larger group of academics that will undertake the module as a part of their regular professional development activities for the semester as a four-week online course. Evaluation of the trial cohort and the pilot cohort will be conducted through two methods. Firstly, participants will be surveyed on their experience with the module. Secondly, an analysis will be conducted of the course outlines and course design documents that the participants are expected to complete throughout the module to assess whether the key concepts are being applied effectively. The results from the initial trial and the formal pilot will be used to revaluate and adjust the content of the framework before it is opened to the larger academic community within the University.

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Mobile realities and dreams: Are students and teachers dreaming alone or together?

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The use of mobile technologies and social media for teaching and learning signals the potential for ontological shifts in learning and teaching, redefining the roles of both students and lecturers. Understanding tertiary student perspectives on how they use wireless mobile devices for learning is crucial if their lecturers are to make informed evaluative decisions about how they use those same devices in their teaching. Lecturers require professional development in using mobile technologies in teaching, and institutions face challenges with infrastructure. This paper outlines a research proposal for exploring tertiary student use of wireless mobile devices for learning and the relationship of that to lecturer and institutional readiness in a blended learning environment. Cochrane's (2012) six critical success factors for transforming pedagogy with mobile Web 2.0 and Puentedura's (2012) SAMR model of technology adoption will be used as evaluative frameworks.

Keywords: Mobile learning, blended learning, tertiary education, transformative education

Introduction

Wireless mobile devices (WMDs) (Cochrane, 2012), such as smartphones and tablet computers, are an increasingly every day item. As with other technological innovations, like the radio and the television, there has been a subsequent wave of excitement in the tertiary education sector about the potential of such devices for redefining teaching and learning. The promise of mobile learning is the potential for socially constructed learning, with learners at the centre of knowledge construction.

As with all educational technology innovations, there are concomitant issues and considerations from both teachers and students. The motivation for exploring student use of WMDs stems from the researchers' experiences of being lecturers in a blended learning environment at a private training establishment. The research will explore the student perspective on mobile learning in comparison with lecturer and institutional readiness for providing teaching and learning environments which facilitate mobile learning. Cochrane's (2012) six critical success factors for transforming pedagogy with mobile Web 2.0 and Puentedura's (2012) model of how a particular technology impacts on teaching and learning will be used to explore:

- the student perspective on mobile device use for learning;
- student expectations of lecturers and institutions to provide learning environments which create opportunities for mobile learning;
- the capacity of lecturers and institutions to meet student expectations of mobile learning; and
- the juxtaposition between student expectation, and lecturer and institutional capacity to provide mobile learning environments.

Yoko Ono said "A dream you dream alone is only a dream. A dream you dream together is a reality" (Sheff, 2000). Do students dream of WMDs transforming and redefining their learning experiences? Do lecturers dream of WMDs transforming and redefining their teaching? If so, can these dreams then be a reality? Cochrane's critical success factors and Puentedura's model in tandem may reveal the nexus of student expectation and lecturer capacity.

Wireless mobile device use in education

WMDs which have internet connectivity, such as smartphones and tablet computers, are now ubiquitous (at least in the developed world). In the first quarter of 2013, worldwide mobile broadband subscriptions were approximately 1.7 billion, with that figure forecast to hit 7 billion in 2018 (Ericsson, 2013). Currently, mobile market penetration is 120 – 125% in New Zealand (New Zealand Mobile Communications, 2013). WMDs, such as tablet PCs and smartphones, are referred to as game changers in education, offering opportunities to enhance learning and teaching (Geist, 2011; Johnson et al, 2013; Pegrum et al, 2013; Traxler, 2010). This is due to their affordances of collaboration, anytime/anywhere learning, ease of use, portability and ubiquity (Pachler, Bachmair & Cook, 2010). There is much discussion about the potential of WMDs to facilitate socially constructed learning (Cochrane, 2012) for students in communities of practice (Wenger, 1998).

Student use of wireless mobile devices

In higher education, mobile apps and tablet computers are already being embraced by institutions (Johnson, Adams & Cummins, 2011; Johnson et al., 2013) as tertiary student use of mobile devices is also very common (Melhuish & Falloon, 2010; Pegrum et al, 2013). While it is pertinent for institutions to understand the pedagogical value and use of WMDs in enhancing learning and teaching, it is also important to understand the student perspective. If so many students are making use of these devices in their personal lives, how do they perceive the impact of those devices on their educational experience? At the same time, what are their resulting expectations of lecturer and institutional provision of learning environments which enable mobile learning?

Students report that mobile learning offers flexibility through always having access to information and learning activities on the internet, and being able to learn whenever and wherever they are (Bradley & Holley, 2011; Kukulska-Hulme et al., 2011). Mobile use of social media also enables students to connect with other learners in a variety of ways when they are outside of the classroom (Merchant, 2012).

Mobile learning and redefining teaching and learning

Other researchers have called for and proposed frameworks to evaluate WMDs (Traxler, 2007; Vavoula & Sharples, 2009). A current project led by the Australian Digital Futures Institute at the University of Southern Queensland is attempting to address the high pace of technological development in WMD use by generating an evaluative framework which can assess whether any mobile learning initiative is " successful, scalable and replicable" (Farley & Murphy, 2013). Based on six years of mobile learning action research projects, Cochrane identified six critical success factors for implementing pedagogical change WMD use (2012, p.9):

1. The pedagogical integration of the technology into the course and assessment.
2. Lecturer modelling of the pedagogical use of the tools.
3. Creating a supportive learning community.
4. Appropriate choice of mobile devices and Web 2.0 social software.
5. Technological and pedagogical support.
6. Creating sustained interaction that facilitates the development of ontological shifts, both for the lecturers and the students.

The most crucial of the above six factors is the sixth (Cochrane, 2012) because, through achievement of the first five, the roles of those involved in teaching and learning can be reconceptualised. The teacher and learner respectively can move "from content deliverer to facilitator of authentic experience [and] from passive participant to active co-constructor of knowledge" (Cochrane, 2012, p. 9). This reconceptualisation of teaching and learning, as opposed to the mere superficial use of technologies simply because they are available, should be the ultimate aim of adopting any technology for educational purposes.

Puentedura's (2012) Substitution, Augmentation, Modification, Redefinition (SAMR) model of technology use in teaching and learning dovetails with Cochrane's sixth critical success factor.

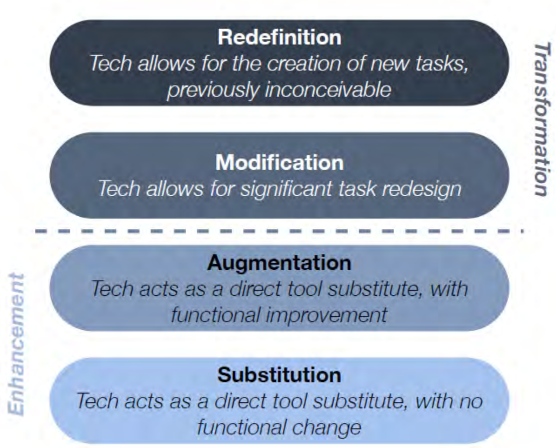

Figure 1: Puentedura's (2012) SAMR model

Substitution is the most basic form of technology use, where the technology replaces an existing tool; for example, typing notes on a tablet instead of handwriting them during a lecture. Augmentation occurs where the technology enhances the activity; for example, using a note taking app which also files notes during a lecture. Modification occurs where the technology enables the activity to be done differently; for example, using a note taking app which also allows students to communicate with each other and share questions/ideas during lectures. Redefinition occurs where the technology creates the opportunity for a task that would not have been possible without it; for example, flipping the classroom (Sams & Bergmann, 2013), by having those students view an online video tutorial and then attend their class to work together on a related project, co-constructing knowledge rather than being passive receivers.

The research

This research aims to understand the perspectives of students on the use of WMDs in their learning. Another aim is to gauge at which stage of the SAMR model the students rate their lecturers and institution to be and to what extent that meets their own expectations of WMD use. The researchers infer there is a tension between student expectation, lecturer capacity and institutional infrastructure. The participants will be international post-graduate early childhood education students (the cohort is approximately 50) and some of the lecturers (who number 20 in total) at a private training establishment.

The students study in a blended learning environment via a home grown LMS and attend mandatory four hour tutorials once a week. The LMS houses the students' course materials and assessments. Students participate in compulsory online asynchronous discussions which are assessed and contribute to their final grades. The weekly tutorials follow the content of the online course materials.

Some of the students use WMDs during the face to face tutorials, with lecturers observing that the devices are used for note taking and information searching during group work activities. Students post in the discussion forums in the LMS for assessment purposes, but the researchers have observed that some of the students, when posting in the LMS online discussions, are referring to previous online communications they have had, which do not appear in the record of the LMS online discussions. A group of Chinese students have set up their own learning community using iChat, for example. It would be interesting to know what online spaces the students are using to communicate with each other and how they perceive the effect of their WMD use on their learning experiences. At least among those making regular use of WMDs for learning, we predict that students would like their learning environments to at least be at the Modification stage of the SAMR model.

The researchers have observed considerable variation in lecturer use of WMDs in their teaching, with them being clustered into three main camps. One group of lecturers are highly critical of students using WMDs during class, with some banning them altogether. Other lecturers are interested in using WMDs but require professional development to integrate them into their teaching. The third, and smallest, camp are experienced WMD users who encourage student use of those devices. Given that the large majority of lecturers are not using WMDs in their teaching, the first four of Cochrane's critical success factors for implementing pedagogical change through WMD use are probably not being met. This would place some lecturers at the Substitution, or at best

Augmentation, level of the SAMR model, while other lecturers would not register at all.

Wireless internet is available on campus, however, there are restrictions on various websites, with social networking sites being barred altogether. The home grown LMS, aside from the online discussions, is an online filing cabinet (Kelly, 2003), and lacks suitable plug ins that would be available and easy to install with other LMSs like Blackboard or Moodle. The aspiration is to develop the LMS, however, in house development requires considerable planning.

The research will explore the following overall questions concerning WMD use for learning and teaching:

1. To what extent do students perceive that wireless mobile devices redefine what learning is for them?
2. What is the capacity of lecturers and the institution to meet student expectations of WMD use?
3. How do student expectations of wireless mobile device use for learning, lecturer approaches to the use of those devices in teaching, and institutional infrastructure interact?

The students and lecturers will be provided a questionnaire for initial data collection. Based on the questionnaire responses, further data collection will be carried out in the form of semi-structured interviews with some or all of the participants.

Conclusion

The researchers perceive a mismatch between student expectation and lecturer/institutional capacity. We predict potentially strong tensions between student expectation of mobile learning, lecturer need for professional development in the pedagogical use of WMDs and the institutional infrastructure. The nexus of student expectation and lecturer capacity is potentially, therefore, a disparate one. There appear then to be some barriers to overcome if we are to reach Puentedura's Redefinition stage and attain Cochrane's ontological shifts in learning and teaching. Recalling Yoko Ono's statement, can students and lecturers dream together about mobile learning and therefore make the potential redefinition of learning and teaching a reality? Or is that only a dream?

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Retrofitting teaching spaces: Did our dreams come true?

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Using Appreciative Inquiry an evaluation of newly retrofitted and upgraded centrally timetabled teaching spaces took place following the first semester of use. Survey instrument items and interview prompts were derived from a metasynthesis of relevant reviews, each informed by current 'learning spaces' literature. Teaching staff (N=28) completed an online questionnaire and/or attended interviews (N=4). Their experiences and opinions with regard to the technology; the fitness for teaching purposes; the room layout, décor and furniture; and the support offered is discussed. Implications and future directions are indicated.

Keywords: teaching spaces, learning spaces, evaluation.

Introduction

Charles Darwin University (CDU) located in tropical Darwin, Northern Territory, is one of 5 dual sector tertiary providers in Australia. Billany (2012) reported at *ascilite* 2012 on the factors that informed the design principles that were used in the retrofitting of a large number of learning and teaching spaces at the main campus. A comprehensive review of the centrally managed teaching spaces, and their use, was undertaken by members of the Office of Learning and Teaching (OLT) (West, Billany, & Garnett, 2012). It involved consultative interviews with teaching staff using questions derived from an Appreciative Inquiry, a positive approach to change, (Whitney, & Trosten-Bloom, 2010) to focus on the positive aspects of retrofitting and the 'Dream' factor of the 4-D cycle (Discovery, Dream, Design, Destiny) rather than reflecting on a deficit model. The teaching spaces were subsequently retrofitted and made available for teaching in Semester 1 2013 followed by the evaluation phase of the project.

The stated main aims of the evaluation were to identify:

- the usefulness of each technology in the rooms
- the fitness of the rooms for their teaching practice and student learning
- any changes in their teaching practice or student behaviour
- the strengths of the improvements to inform future planning.

Evaluation of University Learning Spaces

The literature that informed the evaluation of teaching and learning spaces incorporated a number of reviews (Mitchell et al., 2010a; McNamara, & Rosenwax, 2012; Pearshouse et al., 2009; Swinburne University, 2011). Recurring common themes included the complexity of the phenomena under evaluation and whether it is possible to evaluate the effect of teaching spaces on actual student learning outcomes.

This project was complicated by the requirements of timing and budget constraints which meant that a range of types of teaching spaces were retrofitted simultaneously. It is due to these reasons that this evaluation focusses on the experiences and opinions of the teaching staff and their perceptions of the effects of the retrofitting.

The Framework for the Evaluation of Learning Spaces (FELS) (Pearshouse et al., 2009) provides a useful and practical guide through a common vocabulary, a checklist of issues to be considered, and a structure to follow.

The evaluation proposal for this project involved a number of parts:
1. Questionnaire
2. Follow up interviews with individual lecturers
3. Review of incidents with new equipment as reported to the Teaching Space Support Team Help Desk
4. A comparison of timetable bookings with equivalent semester last year
5. Pre and post comparison with the Association of Educational Technology Managers (AETM) guidelines (AETM, 2012).

This paper describes the method and results from parts 1 and 2 only.

Method

Participants

This is a dual sector university and the target population ratio (92:19) of lecturers Higher Education (HE): Vocational Education & Training (VET) was represented in the questionnaire sample (23:4, plus one unknown) of 28 participants from 10 of the 18 Schools and Institutes. The School of origin was not reported by two participants. The HE subsample was equally distributed across the two HE Faculties at the university (43%;36%), with a higher proportion from one school in each Faculty (18% from Education and 25% of total sample from Psychological and Clinical Sciences). The reported student groups taught in the rooms were 59% (16/27) internal and 41% (11/27) both internal and external. Participants mean rating of their general teaching style was 66.0 (SD = 19.6) on a continuum from unstructured and strongly student-centred (0) to structured and teacher led (100). Four staff members offered to participate in a follow up interview.

Design

A mixed methods approach has been used for the evaluation eliciting both quantitative and qualitative data. Analysis of the quantitative data involved descriptive statistics and analysis of the qualitative data from both the questionnaire and interviews employed content analysis.

Measures

A metasynthesis of four reviews, each providing a current and critical review of the literature from different perspectives was the basis for the survey design. These four frameworks included the:
1. Five issues raised from the outcomes of the design of the retrofitted teaching spaces (Billany, 2012): the types and layout of technology in the room; the interaction between the student groups; the multiple roles of the lecturer; the pedagogical strategies used in the room; and, the support requirements.
2. Eight key pedagogical principles (Mitchell et al., 2010b) specifically based around the retrofitting of university learning spaces. Spaces should: support a range of learners and learning activities; provide a quality experience for users; help foster a sense of emotional and cultural safety; enable easy access by everyone; emphasize simplicity of design; integrate seamlessly with other physical and virtual spaces; be fit-for-purpose, now and into the future; and, embed a range of appropriate, reliable and effective technologies.
3. Six key areas of activity for the teacher as summarised by Harden, and Crosby (2000): information provider; role model; facilitator; assessor; planner; and, resource developer.
4. Six key principles which have been identified at CDU as a current focus for learning and teaching: active learning, structured learning, feedback, teacher presence, collaboration, inclusiveness.

A matrix was used to map these 25 issues, principles, and areas. There were commonalities and differences which led to development of the survey tool. The questionnaire consisted of a series of blocks of items covering the following domains: Participant information (including an item on teaching style); Technology; Fitness for teaching purpose; Room layout, décor and furniture; Support; and a set of Miscellaneous questions. The interview prompt guide followed the same design.

Procedure

At the end of the first semester, 111 academic staff timetabled to teach in any of the retrofitted rooms (the target population) were invited by email, to participate in the evaluation. A link to the online questionnaire, administered using Qualtrics (www.qualtrics.com), enabled them to participate in their own time and space. There were also invited to be interviewed in depth about the impact of the retrofitting. Inductive and deductive thematic analysis followed and exemplar phrases included.

Results

Qualitative information from the textual responses in the questionnaire and the interviews have been aggregated and interpreted with the quantitative items to explain the experiences and opinions about the retrofitted rooms.

Technology
The overall mean of positive rating for Technology was 74.6% and fulfils the first aim (the usefulness of each technology). Of the new and upgraded technologies placed in the rooms all were rated useful to very useful. The four considered most useful were: the support telephone (previously only one support telephone per building); the in-built presenter computer (previously not all rooms had an in-built computer); the document camera/visualizer; and, the cameras and microphones designed for use with Blackboard Collaborate.

Fitness for teaching purpose
The overall mean of positive rating for Fitness for teaching purpose was 73.5% which addresses the second aim (fitness of the rooms for their teaching practice and student learning). Sixty-four percent of the participants responded to the 'what types of learning activities do you find this room has facilitated well?' A comparison between the number of activities pre and post retro-fitting produced an average increase of 1.7 activities. It seems more than didactic teaching is taking place with comments stressing facilitation of group work due to the flexibility to rearrange the desks and chairs. However, one room, a large flat seminar room was strongly critiqued as "this technology isn't conducive to interactivity. It still orients learners to the walls - it directs their gaze away from one another and from dialogue".

There was a favourable response at rate of two positive to one negative comment regarding the ease to make transitions between the different learning activities the room afforded. One participant added the new touch pad enabled seamless transitions, however, another noted a lag time and that "the technology made 'hot swapping' more like cold starting".

In response to the changes they have made to their teaching 25% of the participants reported the flexibility to use different learning activities and make seamless transitions between them was important. The following provide examples of changed teaching practice (part of aim 3). In particular one lecturer stated the "wireless presenter facilitated using the tablet and hence it was easier to show calculations and record the lectures for external students through Collaborate at the same time". To balance this only 18% noted a retrograde step, one adding "(e.g. the Epson iPad app does not equate to screen mirroring via a bulk-standard VGA connector: there is no VGA connector now!)".

An open ended question about the impact of the room retrofitting on their role as a teacher elicited twelve textual comments. A number were lengthy responses (one nearly 300 words). Three revealed more about anxiety related to potential equipment failure, in contrast two reported less embarrassment now about inviting guest lecturers and confidence in the multimedia. Unfortunately one lecturer plans "to make absolutely minimal use of the equipment in this room owing to the presence of multiple 'single points of failure'; the potential for tampering with equipment or theft of critical components (e.g. pens and batteries) is a significant disincentive".

Room layout, décor and furniture
Ninety percent of participants responded to questions about these qualities of the room post retrofit, 81% agree the room is comfortable; 77% welcoming and 71% adaptable.

Twice as many participants responded that they would be proud to show their family and friends the room in which they teach. One lecturer said "the upgrades are fantastic!", another that the "furniture is great", more added a vote of thanks which was unsolicited. Others report it is too dark or too bright, noisy, boring, had no clock and was like kindergarten. An unexpected and positive response was the "new furnishings ... made us all feel happier in the room", adding to an affective (emotional) aspect of the space for users which is often under-reported and should be investigated further.

Support
Ninety-three percent responded to the question to rate the training sessions held for staff at the start of semester one 2013 and on average rated the sessions above 80% (4.83/6). More importantly, 96% rated them positively. Possibly due in part to the training 39% of the participants reported no technical issues throughout the semester, however, seventeen (61%) reported at least one.

Considering there were 28 respondents to the evaluation survey and each was asked to nominate three technical issues only 37 were listed. The most common was the touch pad and logging in (9 reports, with 3 from one respondent). Eighty-nine percent of these were resolved by phoning IT for support. In an interview the participant who had 3 such issues said that the response was swift and hardly interrupted the session. The next most often reported issue was the batteries (6 reports) which were solved 67% of the time by themselves. Problems with acoustics generated 4 reports which were solved by them self or by phoning for IT support.

Miscellaneous
For additions to the room, of the 89% of respondents, there were 67% (N=16) who would add on average 1.6 items. Only 20% of the same 89% of respondents suggested 1.1 changes to the room. The most commonly requested items (23%; 11/47) for addition or change were related to microphones and monitors. Other technological additions/changes related to user-friendly SmartBoards, better connectivity to alternate devices, providing spare batteries, making all rooms Blackboard Collaborate compliant and ensuring reliable equipment. The non-technological additions/changes accounted for 34% (16/47) of the items. Thus these must be almost as important to the lecturers. They included more and larger desks, staff seating on podium, swivel chairs, a clock, thermostat and a door stop.

Only 18% of the lectures would remove anything from the room and 75% of these suggest there is an issue of old and potentially unsafe furniture remaining that needs to be cleared. Two reported unexpected uses and both noted the room unlocked, one saying the equipment was still on.

Some 14% (N=4) added a textual response to the open-ended final question about anything important that had not been raised in the survey. One lecturer adds a thank you and asks if Blackboard Collaborate capability will be extended to all small rooms in due course. A second suggests concerns might have been ameliorated if a consultative process was undertaken at the outset. A third wrote nearly 200 words, acknowledged all the work put into the project but, given budgetary constraints, would have liked more reliable and robust equipment in fewer rooms. In their text they use the words ‘feel’ and ‘disappointed’ which adds resonance to a missing affective component. This is reinforced by a lecture who would like more SmartBoard features and then adds ‘hope’ the prior user docked the mouse for charging.

Discussion and Conclusion

This paper reports only a preliminary interrogation of the data which shows approx. 75% of the sample were satisfied in the room retrofit to meet their needs as teachers. It is encouraging to report that external students have been brought in to the campus classroom as was a key requirement for this project (Billany, 2012).

There is still further analysis to undertake on the current data set, e.g. a more thorough inferential statistical analysis by room type, school, teaching style, student type. Also, discourse analysis of the textual and interview responses may reveal more about the latent affective component.

A threat to external validity might be the sample size, however it was representative of the dual sector nature of the institution. Opportunistic sampling of the target population revealed that many of the staff invited chose not to participate. Speculation might infer they were just too busy or were indeed satisfied with the rooms and how they facilitated their teaching. However, this paper has provided some useful guidance in relation to the fourth aim (strengths of the improvements to inform future planning). Future training and further updates that can be made to the rooms and how to adjust this design for future retrofitting. Future training sessions might also include actions that can potentially ameliorate any anxiety felt by lecturers and provide them with more confidence to have a go with more and different activities that these new technologies afford.

We thank the lecturers for their time (ranging from 2 to 42 minutes [mean = 17 min; SD = 11 min]) to complete the online evaluation. Their responses have been valuable in fulfilling the four aims of the paper. And the final word goes to a lecturer with many years of experience teaching in rooms at CDU who stated “Thank you a great

room to teach in I have worked at CDU for 13 years and this has been the best room by far to teach in".

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Blended synchronous learning: Patterns and principles for simultaneously engaging co-located and distributed learners

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This paper presents seven blended synchronous learning designs and articulates principles for implementation as espoused by the teachers who enacted them. Blended synchronous learning approaches use media-rich synchronous technologies to enable remote and face-to-face students to co-participate in the same live classes. A wide range of technologies (video conferencing, web conferencing, virtual worlds), tasks (collaborative evaluation, group questioning, class discussion, problem solving, collaborative design) and levels of student interaction (from lightweight to tightly coupled) were present within the blended synchronous learning designs. The main issues that teachers confronted when teaching blended synchronous lessons were communication issues and issues related to cognitive overload caused by split attention. Key pedagogical principles for enactment as identified by the lead teachers included the need for extensive preparation, clear instructions, composure, flexibility, advance preparation of students and savvy utilisation of support staff. These findings represent initial results from an Office of Learning and Teaching project entitled 'Blended synchronicity: Uniting on-campus and distributed learners using media-rich real-time collaboration tools' (further details available at http://www.blendsync.org/).

Keywords: blended synchronous learning, video conferencing, web conferencing, virtual worlds

Introduction

The traditional notions of the on-campus university experience are changing, with many students choosing to participate wholly or partially away from their institutions' campuses (Gosper, Green, McNeill, Phillips, Preston & Woo, 2008). The decision by many students to not attend classes or to enrol in online or distance mode is driven by lifestyle demands encompassing intensive and often irregular work, family and social commitments (James, Krause & Jennings, 2010). As a result of these changes in attendance patterns and enrolment modes, universities need to find new ways to engage students in learning activities that can be effectively undertaken irrespective of their geographic location. A key challenge is the provision of collaborative learning activities, which are a cornerstone of contemporary social constructivist pedagogical approaches and which are also essential in preparing graduates for the modern workplace (Dillenbourg, 1999; Goodsell, Maher, Tinto, Smith & MacGregor, 1992).

To date, remote students have tended to be supported in their learning primarily through asynchronous activities and resources such as recorded lectures, electronic documents, and discussion forums provided within a learning management system (LMS). However, these asynchronous methods may not provide effective support for learning in cases where students need to engage in real-time conversations, where they need to rapidly share audio/visual content, or where presence and community are important elements of the learning episode. The fact that remote students may not be receiving an equivalent education to their on-campus counterparts has been identified as an issue by Australia's Tertiary Education Qualification Standards Agency (TEQSA, 2013).

In this context, learning designs using media-rich real-time communication tools such as video conferencing (both desktop – e.g. Skype – and room based), web conferencing (e.g. Adobe Connect, Blackboard Collaborate, Wimba) and 3D virtual worlds (e.g. Second Life) have become increasingly popular (Bower, Kennedy, Dalgarno, Lee, Kenney & de Barba, 2012); their synchronous and multimodal nature can be used to facilitate efficient discussion, content exchange and identity representation. (See Bower, Kennedy, Dalgarno & Lee, 2011 for a more detailed argument about the potential of media-rich synchronous tools within the problem context.) Moreover, as can be seen in the brief literature review below, some academics are starting to use blended synchronous learning approaches as a means of simultaneously engaging remote and face-to-face students in the same live experience using these media-rich real-time technologies. This provides remote students with the ability to participate in live on-campus classes, thus addressing the equivalence-of-experience issues identified by TEQSA.

This study examined seven blended synchronous learning designs and the insights of the teachers that enacted them, with the goal of helping to inform and refine blended synchronous learning practices. It is part of an Australian Office of Learning and Teaching Innovation and Development project entitled 'Blended synchronicity: Uniting on-campus and distributed learners using media-rich real-time collaboration tools' (please refer to http://www.blendsync.org/ for further information about the project).

Research and developments in blended synchronous learning

Educational researchers propose several benefits of using blended synchronous learning approaches. It enables equity of access for students who are geographically isolated or cannot physically attend classes due to life demands (Norberg, 2012). For instance, blended synchronous learning enables people who cannot be present in person because they are working full time, need to mind children, or are ill to still participate in on-campus learning experiences (Pope, 2010). Irvine (2009; see also Irvine, Code & Richards, 2013) frames the argument for what she calls 'multi-access learning' as being one of addressing students' need for flexibility and choice by affording them the ability to select and customise the modality or modalities through which they access classes, regardless of their enrolment mode. Moreover, blended synchronous learning accords with evidence indicating better course and program completion rates for students who partake in synchronous interactions with their teacher and peers rather than relying solely on asynchronous communication (Norberg, 2012; see also Power, 2008; Power & Vaughan, 2010). It can allow participants to experience an instructor's lesson, ask and answer questions, offer comments in class and generally allow engagement "in a similar manner to on-campus students" (White, Ramirez, Smith & Plonowski, 2010, p. 35). Blended synchronous learning has also been used in less structured teaching contexts, such as to promote discussion and cooperative learning in graduate and higher degree research classes (Roseth, Akcaoglu & Zellner, 2013; Stewart, Harlow & DeBacco, 2011). Blended synchronous learning can be used to create an enhanced sense of community between remote and face-to-face participants (Lidstone & Shield, 2010).

There is wide variety in the tools and affordances used to facilitate blended synchronous learning. Examples include web-conferencing systems like Blackboard Collaborate (Spann, 2012) and Saba Centra (White et al., 2010), virtual worlds like Second Life (Beltrán Sierra, Gutiérrez & Garzón-Castro, 2012), chat rooms with video feeds (Lidstone & Shield, 2010), and even custom-built systems comprised of tools like Etherpad, Google Hangouts, Piazza and online forms (Roseth et al., 2013). The way in which tools are organised and arranged in multimodal clusters impacts upon how they are used. For example, Lidstone and Shield (2010) comment that their 'postage stamp'-sized video feed of the classroom was used as a 'cueing' device to enhance a sense of connectedness for distance students using text chat, as opposed to being used as a transmission device for content and interaction (p. 96).

The performance of the platform in terms of functionality and reliability is similarly critical to the effectiveness of the lesson (White et al., 2010). Lags in audio, for example, can be highly detrimental to the success of blended synchronous learning activities (White et al., 2010). This can lead to teachers choosing low-bandwith tools such as text chat over higher bandwidth options such as audio and video (Lidstone & Shield, 2010).

Capturing appropriate video feeds as the teacher moves around the class can also be problematic (White et al., 2010). Care must be taken to ensure that the face-to-face classroom experience is not adversely affected by the technology interfering with normal lesson activities or the teacher being overly distracted (White et al., 2010).

Attempting to teach remote and face-to-face students simultaneously can result in an exponential increase in teaching demands (Norberg, 2012). For this reason, it may be necessary to limit student numbers in order for teachers to effectively manage and support the blended synchronous learning experience (White et al., 2010). Student technical skills and familiarity with the communication platform are issues that warrant consideration before attempting to teach using blended synchronous learning approaches (White et al., 2010).

The use of a teaching assistant is often critical to the success of blended synchronous learning experiences, because they can attend to technology-related problems and other issues not related to the core aspects of the lesson (White et al., 2010). It has been suggested that increasing the ratio of teaching assistants to participants may be necessary to minimise disruptions to lessons (White et al., 2010). Having multiple teachers involved in class discussions can also lead to a richer learning experience for students (Lidstone & Shield, 2010).

To date, there have not been any collective case studies of blended synchronous learning documented in the literature that can be used as a basis to understand how to enhance practice in this area.

Method

Case-study partners were selected from 1,748 responses to a 2011-2012 survey of Australian and New Zealand educators on their use of media-rich synchronous technologies (see Bower et al., 2012). Criteria for selection of case-study partners included: (a) whether they were synchronously uniting face-to-face and remote students using rich media technologies; (b) the extent to which the case involved high-quality pedagogical practices; and (c) the maturity of the design in terms of number of implementations. Cases were also selected so as to represent a range of technologies and discipline areas. Discussions were held with potential case-study partners to determine appropriateness for inclusion in the project and willingness to participate. This resulted in the selection of seven case-study partners. Prior to case-study observations, the project team worked with case-study partners to reflect upon and in some cases refine the pedagogical and technological aspects of the blended synchronous learning designs. However, it is important to note that the extent to which designs were adjusted was always at the discretion of the case-study partners.

Several sources of data were collected from each case study as part of the project. This included: (a) a pre-observation teacher-documented overview of the case as it had been implemented in the past; (b) pre-observation teacher interviews in order to determine the rationale for the designs as well as teachers' insights into the blended synchronous learning approach; (c) video and screen recording of the blended synchronous learning lessons; (d) researcher observations of the lessons; (e) post-observation student survey responses; (f) post-observation student focus group interviews; and (g) post-observation teacher interviews. The summary of each of the designs was derived from the pre-observation teacher-documented overviews, the researcher observations of the lessons, and the video and screen recordings of the blended synchronous learning lessons. The project team worked collectively to compose the lesson summaries and used the multiple data sources to triangulate and cross validate the accuracy of descriptions.

The examination of teacher perceptions of blended synchronous learning issues and principles was based upon teacher responses to the pre-observation interview questions that focused on blended synchronous learning problems as well as the key strategies that they employ. Pertinent aspects of the transcribed teacher pre-interviews were extracted and then classified using an open-coding phase to determine preliminary analytic categories. Next, axial coding was carried out to determine emergent themes and refine categorisations. Lastly, a selective-coding phase supported representation of the conceptual coding categories for reporting purposes. (See Neuman, 2006 for further details on this approach.) The blended synchronous learning designs are described below, followed by an explication of pedagogical issues and strategies espoused by the teachers.

Blended Synchronous Learning Designs

Learning design #1: Web conferencing to develop investment understanding (collaborative evaluation task)

In this learning design, a small team of finance and actuarial studies academics implemented a collaborative evaluation activity using the Adobe Connect web-conferencing system. After the teacher briefly introduced the task, remote and face-to-face students were randomly grouped into two breakout rooms where they were asked to evaluate the written responses of two past students to an examination question. The students negotiated marks for the responses using text chat and summarised findings about examination technique in a notes 'pod' (sub-window). The random grouping meant that people in the local classroom did not necessarily have the opportunity to talk with one another. However, using the web-conferencing system in this way 'levelled the playing field' for remote participants in terms of access and interaction. A lack of student understanding of how to operate the technology initially interfered with their ability to undertake the exercise. A teaching aide provided substantial operational assistance to ensure that remote students were receiving all teacher communications and were able to contribute to discussions. The teacher (with the assistance of the teaching aide) was then able to share groups' findings and discuss them with the class. The blended synchronous learning design did in fact enable remote and face-to-face students to successfully complete the collaborative evaluation activity.

Figure 1. Face-to-face classroom setup

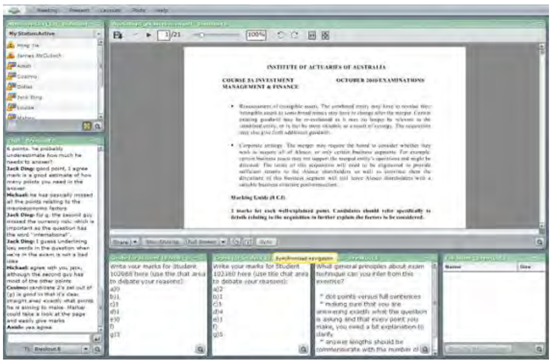

Figure 2. Remote student view

Learning design #2: Room-based video conferencing to develop understanding of healthcare quality improvement approaches (collaborative evaluation task)

Access Grid video conferencing was employed in this design to bring together and simultaneously engage students across three university campuses. The lesson, in the discipline of health informatics, involved a combination of a lecture and a small-group activity culminating in the groups reporting back to the whole class. There was a lecturer and tutor present at one of the sites and only a tutor present at a second site. The Access Grid setup at each campus involved the use of multiple screens showing video feeds of each of the other sites along with presentation slides displayed by the lecturer. During the report-back phase, students made use of a networked interactive whiteboard to share their notes with students at the other sites. The lesson generally proceeded smoothly with students on all sites able to participate effectively. Minor issues included an inability for students to hear questions asked by their classmates at remote sites, and difficulty in making out the details of the material shared through the interactive whiteboard. The lecturer used encouragement, questions and prompts to involve students at all campuses. The role of the remote tutor in promoting input from remote students emerged as an important element of the lesson.

Figure 3. Face-to-face classroom setup

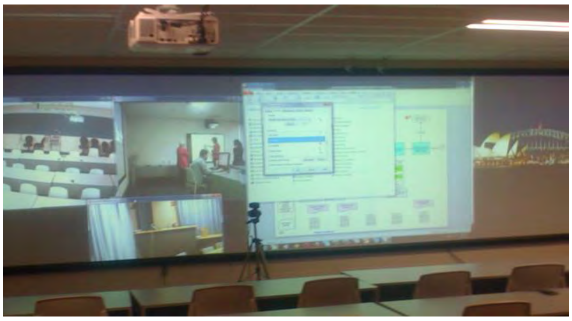

Figure 4. Remote classroom view

Learning design #3: Web conferencing to develop microscopic tissue analysis and interpretation skills (group questioning)

This design used Adobe Connect to bring together on-campus students in a computer laboratory and distance education students participating from off-campus locations to perform an interactive review of medical science (histology) material for an upcoming exam. During the first part of the lesson, the lecturer, wearing a microphone to allow her speech to be audible to remote students through Connect, presented a series of multiple-choice and short-answer questions. Students (on campus and remote) answered the questions using the Adobe Connect student-response tools. Summaries of responses were presented graphically, and the lecturer explained why each answer was correct or incorrect. Students asked clarifying questions either verbally (on-campus students) or using the text chat tool in Connect (remote students). During the second part of the lesson, students were grouped in pairs and asked to complete tissue image identification and labelling tasks in breakout rooms within Connect. Group members reported back on the task and the lecturer supplied feedback and clarification. During the first of those tasks, on-campus students were grouped with on-campus students and remote with remote, whereas during the second task on-campus students were grouped with remote students. Communication between on-campus students was noticeably smoother than that between remote students, with the absence of an audio channel apparently making it difficult to coordinate the labelling task for some groups. The whole-group aspects of the lesson (questions at the beginning and reports back at the end) proceeded smoothly, with the lecturer able to effectively monitor the face-to-face classroom and web-conferencing environment and respond to questions and comments from students in both modalities.

Figure 5. Face-to-face classroom setup

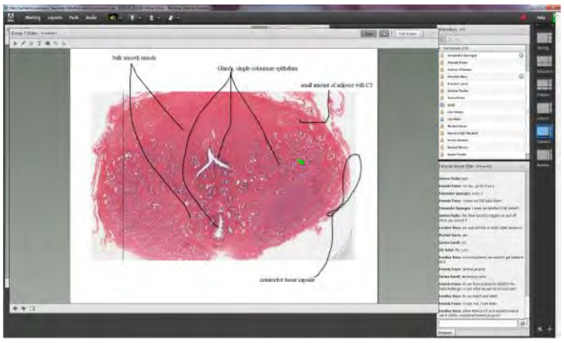

Figure 6. Remote student view

Learning design #4: Web conferencing for participation in statistics tutorials (collaborative problem solving)

This design used the Blackboard Collaborate web-conferencing system to enable remote students to participate in introductory statistics tutorials. The teacher logged into the Collaborate session via her tablet computer so that she could write on the slides in the web-conferencing environment. The screen was projected at the front of the face-to-face classroom so that students who were physically present could see the visual material as well as the list of participants who were attending remotely. The teacher then presented a series of slides that led students through the logic of hypothesis testing, annotating the slides to model problem-solving processes. A range of skills required to solve the problems was demonstrated, including how to select the correct test from a decision chart, how to lookup *p*-values from a table of critical values, and how to run statistical tests using a spreadsheet package. The teacher regularly asked both face-to-face as well as remote students whether or not they understood or had any questions. She then provided time for students to solve problems of their own. Face-to-face students worked individually or in pairs, and remote students worked in breakout rooms using text chat. The teacher sporadically repeated spoken conversation from the face-to-face classroom into the lectern microphone so that students at home could acquire a sense of the on-campus discussion. Although the face-to-face students did not have extensive interaction with the remote students, the blended synchronous learning approach did not to appear to compromise the learning experience for either group to any substantial extent.

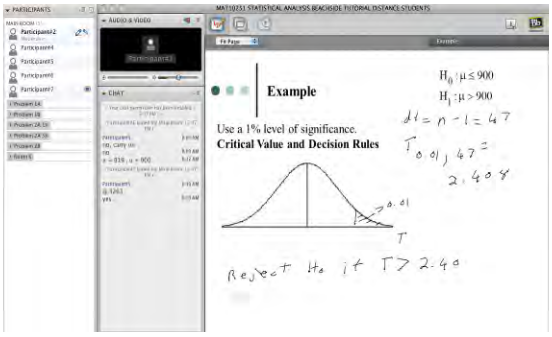

Figure 7. Face-to-face room setup

Figure 8. Remote student view

Learning design #5: Virtual worlds to facilitate Chinese language learning (paired role-play)

In this design, students undertook a tightly constructed role-play activity in Second Life aimed at developing their Mandarin language communication capabilities. Students could either choose to participate in on-campus computer laboratories or from external locations. At the time of the tutorial, students logged in to the virtual world and were grouped into pairs by the teacher, who was both in the physical classroom and in-world. Remote students were paired with face-to-face students, with whom they could interact via voice and text. The objective of the lesson was for students to make a bowl of dumplings in the kitchen of the virtual world restaurant, which required them to ask the automated (scripted) hostess of the restaurant about where they could buy ingredients. They then had to go and buy those ingredients from another automated character at a market, before taking them back to the kitchen of the restaurant and cooking them on the stove. Students communicated with the scripted characters via Chinese-character text chat. Communication between students occurred mainly in English using text chat and/or voice. Because the task and environment were so extensively designed and clearly specified in advance, the teacher did not need to provide much in-class instruction and could instead devote his attention to giving one-on-one assistance to students. At times there was little communication within some of the student pairs; nevertheless, most pairs were able to ask the required questions and navigate the environment to solve the problem and complete the task of making the dumplings.

Figure 9. Face-to-face room setup

Figure 10. Remote student view

Learning design #6: Web conferencing to enable presence in sexology (lecture discussions)

This design involves the teacher holding an interactive lecture discussion with sexology students over two hours using the Blackboard Collaborate web-conferencing system. The content matter of sexology (including sexual function, dysfunction, pleasure and emotions) is often confronting to students, and they need to be taught to concurrently draw upon and distance themselves from their personal experience. In this context, web conferencing is used to provide more embodied presence and participation of remote students in the face-to-face lectures. The teacher presented material but frequently opened up discussion to the students so that they could describe experiences and share their views. On-campus student comments could be heard through the web-conferencing system, and remote students contributed to the discussion using text chat. Participation was also encouraged through a whiteboard graphing activity and a vignette/case-analysis problem. The teacher, through the environment, played a critical role in fostering an open and safe atmosphere that encourages everyone to contribute.

Figure 11. Face-to-face room setup **Figure 12. Remote student view**

Learning design #7: Virtual worlds for teacher education (collaborative evaluation and design)

In this design, remotely located student teachers participated in face-to-face tutorials through the Avaya Live virtual world environment. Students in the face-to-face classroom could see and hear remote students' avatars via a projection of the virtual world on the side wall of the classroom, and remote students could see and hear their face-to-face peers via a video stream within the virtual world. The approach was used in a second-year ICT education subject aimed at encouraging pre-service teachers to consider how emerging technologies such as virtual worlds may be used to enable new forms of interaction and participation. The lesson included a slide-supported presentation, whole-class discussions in which students indicated their perceptions about the utility of virtual worlds, and group brainstorming activities about the use of virtual worlds in education. Student preferences were represented using their physical placement in the virtual and face-to-face classrooms as well as through the raising of hands to vote. Group work was attempted in separate breakout areas in both spaces, with group notes automatically shared on separate surfaces in the virtual world classroom. A design activity was also completed in which groups of students in both environments were asked to design an engaging virtual world lesson that was then subjected to evaluation by the entire class. Network and system issues affected the quality of the student experience, but the trial served as proof of concept that 'blended-reality' (Bower, Cram & Groom, 2010) classes are a feasible learning and teaching approach.

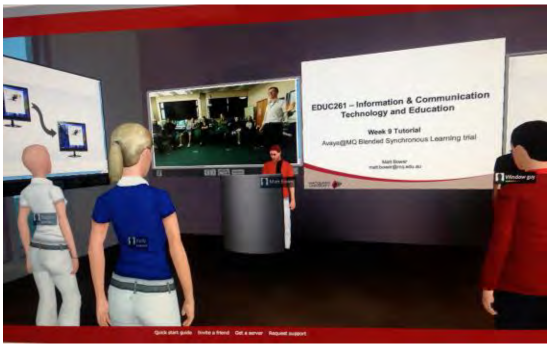

Figure 13. Face-to-face room setup **Figure 14. Remote student view**

Blended Synchronous Learning Issues and Strategies

Issues

Many of the concerns that teachers identified regarding blended synchronous learning related to communication. For instance, they reported having to "constantly check that the remote audience is getting the required information", and if students were using audio then there was a need to "manage turn taking somehow". Additionally, capturing the teacher's voice posed a problem, especially as he/she moved around the room: "physically being near enough to a microphone to be able to actually talk to… students that are in the virtual environment at the same time that I'm talking to the students in the physical environment has been difficult". Capturing audio discussions in the face-to-face classroom without specialised equipment was also problematic:

> One of the things that is a challenge is where the cameras face and where you physically stand and face. There have been times when having to repeat questions [sic] because those online can't hear the questions from a class, so the mike's probably not powerful enough.

If a virtual world was being used to facilitate this blended synchronous learning then the audio communication issues could be duplicated in-world because "it is also a spatial environment; if a student moves away from the space where you have your avatar, then they're not going to hear anything you say, so you have to also at the same time be able to move the avatar". The performance of the underlying technology was also seen by teachers as a crucial factor – for instance, when the technology fails. The students' computer system and Internet connection were also seen to have a critical impact on the remote student experience.

Teachers felt it was particularly challenging to maintain simultaneous awareness of both groups of students. One teacher expressed how it meant being conscious of a dual-student view: "you need to constantly be aware of how you are appearing to students in the face-to-face classroom and also the virtual world". Part of the challenge is that this was occurring in a complex environment demanding that teachers constantly make multiple decisions: "you've got a lot of stuff going on in the background that you either choose to ignore or that you respond to". While it was seen as difficult to determine the perceptions of two cohorts of students, it was also seen as essential to respond to student needs: "if you are not cognisant of that and you don't reflect on how the students are reacting to you… then you won't recognise that those changes in style are required". Discerning the perceptions of both cohorts of students was seen as particularly challenging in a blended synchronous setting because remote student perceptions were not as easily gauged as those in the face-to-face class. Finally, adequately recording sessions was thought to be an important issue, since neither online nor lecture-recording systems would necessarily capture all of the blended synchronous learning discourse and interactions that transpired.

Strategies

Most of the teachers discussed at length the heightened need to be well prepared for blended synchronous lessons ("I would say preparation is key… making sure that you do have everything you need preloaded, well organised before the class starts"). For instance, teachers would "put everything on the LMS beforehand so students have a copy to browse" and "set up breakout rooms with the questions, etc". One teacher observed that the amount of preparation was greater than if teaching purely online or purely face-to-face: "having things set up I think is the heart of it… so it definitely would be easier to do one or the other".

Part of that preparation involved ensuring that "instructions about what to do and how to do it are clear and premeditated, because [in a blended synchronous scenario] it's easy for students not to know". One teacher placed instructions in written form on the LMS before the lesson so that both remote and face-to-face students could access them in advance. One teacher also recommended "pairing remote students with another student in the physical classroom and then making it clear to the person in the physical classroom that they are a conduit of communication if the student in the virtual environment has an issue". This reduced the dependency (and load) upon the teacher in terms of ensuring remote students understood what they were supposed to be doing and also troubleshoot any technical issues.

Teacher direction was seen as crucial to encouraging participation across multiple sites: "you really have to prompt quite strongly to get the campuses that you are not physically attending to get a response… I might say, 'Penrith, this question is for you' or 'Campbelltown, now it is your turn'". Explicit direction was also recommended to optimise student approaches to operating within the blended synchronous environment – for instance, "encouraging students to have iLearn [LMS] and Adobe Connect open at the same time" and asking them to "use the prefix 'Q' for chat contributions to distinguish questions requiring responses from comments [not requiring responses]".

Four of the seven teachers expressed the desirability or indeed need for at least one support teacher: "so the ideal situation probably is where you have two instructors, one who is present in the virtual environment and one who is in the physical environment to ensure that the communication is flowing well through both environments". Others suggested that the support role could include "helping students who might have a problem with the audio" and "keeping an eye on incoming questions". Teachers also identified that the amount of assistance required was dependent on the size of the class – for instance, that a class of 60 students might require two assistants.

Ability to maintain composure was seen as a critical teacher attribute: "When you have technical problems, you can't lose your lolly; instead, you have to think: How long will it be down? What is the cost–benefit of waiting?". The ability to rapidly make decisions about courses of action was emphasised by another teacher:

> If a student's computer goes offline or whatever – there's some hitch at their end where they're temporarily unable to continue, to not participate in the class – how are you going to handle that? If they're able to get back online quickly then probably it's not a big issue. If it takes them 10 or 15 minutes to get back online then it becomes a big issue because you can't make the rest of the class wait around… so you need to have something in the back of your mind as to how you're going to deal with that so that student gets the same learning experience, the same access as the ones that are in the physical classroom.

Teachers also expressed the need to prepare students for the blended synchronous learning experience by "clearly announcing to the students that this is what your computer will need, this is what you'll need to be able to access this, and for the first session, just giving them a chance to play with things and get comfortable before it becomes a bit more high stakes, I guess, with regard to the interactivity". One teacher identified how part of this preparation involved the management of expectations: "Students need to become aware that they won't have physical contact with a lecturer". Some teachers used orientation activities aimed at equipping students with prerequisite technical capabilities. One organised a virtual 'treasure hunt' as such an activity, designed to assist students in gaining the required familiarity with the virtual world. Another teacher also recommended scheduling the session to commence 10 minutes early to allow time for the remote students to test their systems.

In order to address the challenge of communicating with two cohorts of students at once, one teacher pointed out that it was important to ensure "your body is positioned so that it's in an open and available position for both remote and face-to-face students". Clear audio involved talking at a "measured pace that means that your audio is being received by students that are remote... but also not too slow for students in the classroom". Logging in as a student on a second computer was also identified as a strategy to appreciate the remote student view. While there was no definitive strategy for broaching the split attention caused by catering to two cohorts of students at the same time, one teacher's comments intimated that the solution may lie in designing the learning environment so that the focus of activity is self-evident: "If you want to say where is the focus of student attention during the lesson, the focus of student attention during the lesson is very definitely in the virtual environment." If all students are immersed in a single environment, then communicative difficulties imposed by attempting to synchronously blend remote and face-to-face participants may be reduced or even eliminated.

Discussion and Conclusion

The blended synchronous learning designs above demonstrate the range of subject areas and task types that can be supported using media-rich synchronous technologies. Collaborative evaluation, group questioning, collaborative problem solving, role-play, whole-class discussions and collaborative design tasks could all be enacted. Finance, health informatics, biology, statistics, language, sexology and teacher education content could all be represented. A wide range of technologies could also be used, including video conferencing, web conferencing and virtual worlds. In each case, the technological setup and capabilities of the teacher were critical to the success of the blended synchronous lessons and activities.

The main issues identified by teachers regarding the simultaneous teaching of remote and face-to-face students were communication problems (capturing and managing audio discussions) and cognitive load caused by the demands of teaching two cohorts of students at once (having to maintain awareness of the remote and face-to-face student view, operating the collaborative technology, troubleshooting technical issues for remote students, monitoring the reactions/discerning the perceptions of both cohorts). These align with and expand upon problems identified by other researchers (Norberg, 2012; White et al., 2010).

The teachers alluded to several strategies that could be used to alleviate or reduce the impact of these issues, including advance organisation of resources, clear and explicit instructions to students, using face-to-face students to relay communication to remote students, utilising workarounds when systems fail, and having a focused environment in which to conduct collaborative activity. They felt there was a heightened need to prepare remote students for the blended synchronous learning classes in terms of their technological setup, technological skills, and expectations. The majority of teachers believed having a teaching assistant was highly advantageous in helping to deal with the increased cognitive load required to manage blended synchronous learning classes (aligning with recommendations by Lidstone & Shield, 2010 and White et al., 2010).

The present paper has provided only an overview of the designs and reflections of teachers across the seven case studies. Future publications will report in depth on the findings of each case as enacted, taking into account analysis of student data. Furthermore, a cross-case analysis of lessons and student perceptions is also being prepared in an effort to understand the influence of different design elements and strategies. Preliminary results indicate that the way in which the technology is used determines the extent to which students perceive a sense of co-presence and of communication and sharing occurring between remote and on-campus participants, but that it is the task design and pedagogy that influence the depth of learning.

As technology and bandwidth continue to improve, we may be entering an age of ubiquitous participation, where remote participants may be represented in any classroom via video modelling and mixed/augmented reality as though they were actually in the room. Until that time, teachers will need to leverage the potentials of the available media-rich technologies to unite remote and face-to-face students, employing appropriate strategies in an attempt to mitigate or overcome the constraints. This research provides an evidential basis for designing and optimising such blended synchronous learning tasks and experiences.

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Past, present, future time perspectives and maladaptive cognitive schemas: associations with student engagement and attrition rates in an online unit of study

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The aim of the current study was to investigate time perspectives and maladaptive cognitive schemas as predictors of students' academic engagement and unit withdrawal. Two hundred and sixteen students studying an online introductory unit in psychology completed an online questionnaire at the start of the unit. Their enrolment status was checked at the end of the unit. The strongest predictors of unit withdrawal were cognitive schemas and time perspectives associated with failure and hedonism. The strongest predictors of academic engagement were cognitive schemas and time perspectives associated with self-control and a focus on future outcomes. Based on these findings, psychological and pedagogical interventions aimed at increasing student engagement and reducing student attrition in online units of study are suggested.

Keywords: time perspective, cognitive schemas, academic engagement, attrition, online study

Online units of study provide numerous benefits to students, from both pedagogical and economical perspectives (e.g., Tatli, 2009). However, there are also limitations inherent to these modes of study, and this may be why attrition rates are relatively high. Attrition rates for students in online units of study vary, but are consistently higher than those reported for units run on-campus (e.g., Patterson & McFadden, 2009). The identification of factors that potentially influence academic engagement would be significant step forward in minimising student attrition in online units of study.

The learning experience may be different in an online study environment, and "may reduce rather than enhance the quality of learning" (Ramsden, 2003; p. 152). Basic principles of learning and predictors of quality learning interaction (e.g., nonverbal communication; White, 2011) are also potentially compromised in online study. At the tertiary education level, student motivation and engagement may be cued by eye-contact and other nonverbal gestures by the teacher (Zeki, 2009). These cues are compromised in an online environment and therefore may adversely affect student performance.

As well as the inherent limitations in online modes of study, there are student-related factors that may affect appropriate engagement with the learning process. Harrington and Loffredo (2010), for example, investigated personality and learning modality preferences (face-to-face or online) in 166 university students. Introverted participants reported preferring online instruction, whereas extroverted participants reported preferring face-to-face instruction. There appear therefore, to be important individual differences in preferred methods of learning.

Cognitive style is another prominent individual difference factor that has been shown to influence learning engagement in an online study environment. Cognitive style is defined as an individual's consistent approach to organising and processing information (Riding & Rayner, 2000). Information is interpreted through learning heuristics developed by individuals over time. Known as field independence and field dependence (Witkin & Goodenough, 1977), the former cognitive style refers to an individualistic and internally directed approach to learning, while the latter cognitive style refers to a collaborative approach to learning that favours external stimulation and motivation. Field dependent learners have been shown to experience greater learning difficulties than field independent learners in online learning environments (see Alomyan, 2004).

An important factor when looking at cognitive styles is the development of core beliefs, especially when related to the perceptions of self and, in the context of this paper, the effects of core beliefs on learning. The model of cognitive schema developed by Young (1999) adheres to the same cognitive psychology principles mentioned above, in that present experience is interpreted through heuristics developed by individuals over time. Young proposes that maladaptive schemas such as defectiveness, incompetence, entitlement, subjugation, and emotional inhibition are implicated in psychological distress. Young and colleagues (e.g., Young, Klosko, & Weishaar, 2003) have found that the family environment has a fundamental influence on the development of core belief or schemas. However, in contrast to Beck (1996) and in accordance with developmental theorists, they focus on the role of parents, siblings, and peers in relation to the development and maintenance of particularly debilitating maladaptive schemas that continue to affect the child's view of self, such as competence and defectiveness throughout the life-span.

While the focus of Young et al.'s (2003) work was predominantly clinical, it has been demonstrated that schemas also function in non-clinical populations. Baranoff, Oei, Cho, and Kwon (2006) for example, showed that depressive symptoms in an Australian university student sample could be predicted by the early maladaptive schemas of insufficient self-control and failure. As well as the predictive utility of maladaptive schemas for inferring depressive symptoms, it is conceivable that a student's cognitive biases may also affect the learning experience. Unpublished data from a study by Chivell (2009) indicated that, on average, students report an overall higher level of maladaptive schemas compared to community respondents. While there is little data to suggest that the presence of maladaptive schemas necessarily lead to poorer academic outcomes, there are several individual schema that would appear to negatively relate to academic engagement. For example, schemas concerning failure, unrelenting standards, entitlement, and insufficient self-control would appear to reflect a cognitive set in which goal-directed effort, self-efficacy, and diligence, traits that are important for academic success (e.g., Komarraju & Nadler, 2013), are uncharacteristic. It is likely that the presence of such maladaptive schemas extend to (lack of) success in online study.

A new and emerging area of study concerns students' characteristic time orientation. Zimbardo and Boyd (1999) proposed a model of psychological time orientation in which cognitive processes direct the evaluation of subjective experience into a multidimensional framework of time perspectives. Under this model, individuals are considered to occupy space along several dimensions relating to past, present, or future perspectives. Each dimension also incorporates an element of valence, with the 'past' perspective for example, having both positive and negative dimensions, and the 'present' perspective having hedonistic and fatalistic dimensions. A student's characteristic time orientation may have an impact on how much they value the learning experience. The ability to delay gratification, a hallmark of the future time perspective, is closely associated with academic success in traditional educational settings (Shoda, Mischel, & Peake, 1990). Horstmanshof and Zimitat (2007) showed that a future time perspective predicted greater student engagement, using measures of academic conscientiousness and endeavour, in a first-year undergraduate unit at an Australian university. While there are no published studies differentiating time perspectives between on-campus and online students, it is assumed that similar relationships between the future time perspective and academic engagement exist in online units of study.

The overarching aim of this project was to investigate several student factors (time perspective, cognitive schemas) as predictors of academic engagement and student attrition in an online unit of study. It was hypothesised that, consistent with Komarraju and Nadler (2013), higher levels of maladaptive cognitive schemas would be associated with a poorer academic outcome. It was also hypothesised that, consistent with the delayed gratification model of Shoda et al. (1990), a preference for the future time perspective would be associated with a better academic outcome. Finally, it was hypothesised that lower levels of maladaptive schemas and a future time perspective would be associated with greater academic engagement.

Method

Participants

A total of 356 students were enrolled in an online Introduction to Psychology unit at Week 1 of the study period. Two hundred and twenty-one students (62.1%) completed the unit and 135 (37.9%) failed to complete the unit (i.e., withdrew before the exam).

Two hundred and sixteen students (60.7% of the total sample) completed the questionnaire. Of these, 146 (67.6%) eventually completed the unit and 63 (29.2%) did not complete the unit.[6] The average age of all students who completed the questionnaire was 32.40 years (SD = 11.39; range 18-66). There was a slight difference in age between those who completed the unit (M = 33.55, SD = 10.56) and those who didn't complete the unit (M = 29.81, SD = 12.76). The number of female students who participated in the questionnaire (n = 163, 78.7%) far outweighed the number of male students participating (n = 44, 21.3%). There was no significant association between sex and unit completion, $\chi^2(1, n = 207) = 1.86, p = .17$.

Measures

Zimbardo Time Perspective Inventory (ZTPI; Zimbardo & Boyd, 1999)
The ZTPI measures traits of subjective time experience, and includes dimensions of Past-Positive (e.g., "It gives me pleasure to think about my past"), Past-Negative (e.g., "I've made mistakes in the past that I wish I could undo"), Present-Hedonistic (e.g., "I try to live my life as fully as possible, one day at a time"), Present-Fatalistic (e.g., "My life path is controlled by forces I cannot influence"), and Future (e.g., "I complete projects on time by making steady progress"). The overall scale contains 56 items, each rated on a 5-point scale ranging from "very untrue" to "very true". Higher scores indicate greater levels of each trait. Psychometric testing has shown that the ZTPI demonstrates acceptable reliability and validity (Zimbardo & Boyd, 1999).

Young Schema Questionnaire – Short Form (YSQ-S; Young, 1998)
The YSQ-S measures 15 early maladaptive cognitive schemas across 75 items. Each item is measured on a 6-point scale ranging from "completely untrue of me" to "describes me perfectly". The current study used only those subscales that can be theoretically linked to academic engagement and/or student attrition (i.e., Failure, Unrelenting Standards, Entitlement, and Insufficient Self-control). Sample items from these subscales include "I'm not as talented as most people are at their work" (Failure), "I can't let myself off the hook easily or make excuses for my mistakes" (Unrelenting Standards), "I feel that what I have to offer is of greater value than the contributions of others" (Entitlement), and "I have a very difficult time sacrificing immediate gratification to achieve a long-range goal" (Insufficient Self-control). The YSQ-S has demonstrated good-to-excellent reliability, and acceptable validity (Oei & Baranoff, 2007; Waller, Meyer, & Ohanian, 2001).

Work Engagement Scale – Student (WES-S; Schaufeli, Salanova, Gonzalez-Roma, & Bakker, 2002)
The WES-S measures student engagement on a 24-item scale across three subscales – Vigour (e.g., "When I get up in the morning I feel like studying"), Dedication (e.g., I am enthusiastic about my studies"), and Absorption (e.g., "Time flies when I am studying"). The original version has been adapted slightly for the current study so that it makes sense to an online student cohort. Items are scored on a 7-point frequency rating scale ranging from 0 ('never') to 6 ('always'). The WES-S has also demonstrated acceptable psychometric properties (Schaufeli et al., 2002).

Procedure

Students in Week 1 of the Study Period were invited to complete the questionnaire via the Opinio portal, at a time and location that was convenient to them. The link to the survey was made available on the unit Blackboard site. Students could also volunteer to take part in the second phase of the study in which attrition rates were measured. The attrition rate for the whole sample was determined by how many students chose to withdraw from the unit before the final exam.

[6] Note that seven students deferred the exam and were not allocated to either the completers or the non-completers group.

Results

Data were screened for both univariate and multivariate outliers and deleted on a case by case basis. Distributional assumptions were also assessed and while there was some deviation from normality, raw scores were used in the majority of analyses in order to aid interpretation of relationships between predictors and outcomes. Descriptive statistics for predictor and outcome variables are presented in Table 1. It can be seen that all scales demonstrated good to excellent internal consistency.

Table 1: Means, Standard Deviations, and Cronbach's Alpha for the YSQ-S, ZTPI, and WES-S

Variable	Scale	Mean	Standard Deviation	Cronbach's alpha
Cognitive Schema	Failure	11.63	6.00	.93
	Unrelenting Standards	20.63	5.27	.79
	Insufficient Self-control	12.43	5.34	.72
	Entitlement	12.40	4.50	.86
Time Perspective	Past Negative	3.08	0.79	.81
	Past Positive	3.34	0.70	.79
	Present Hedonistic	3.29	0.58	.83
	Present Fatalistic	2.46	0.62	.75
	Future	3.58	0.51	.75
Academic Engagement	Vigour	24.22	6.05	.84
	Dedication	24.70	4.24	.85
	Absorption	23.60	7.67	.90

Table 2 presents the correlations between the predictor variables (ZTPI and YSQ-S subscales) and the outcome variables (WES-S subscales). Correlations in Table 2 are largely consistent with expectations based on theory and scale content. Future time perspective correlated positively with the Academic Engagement scales of Vigour, Dedication, and Absorption, and negatively with the YSQ-S scale of Insufficient self-control. Insufficient self-control also correlated negatively with the Academic Engagement scales of Vigour, Dedication, and Absorption. Consistent patterns of associations with the Academic Engagement scales were not observed for other variables, although Vigour correlated negatively with the Cognitive Schema scale of Failure.

Table 2: Correlation Coefficients Between Scales of the ZTPI, YSQ-S, and WES-S

			ZTPI				YSQ-S				WES-S	
	1 PN	2 PP	3 PH	4 PF	5 F	6 Fa	7 Us	8 Is	9 En	10 Vi	11 De	12 Ab
1	-	-.41*	.25*	.52*	.01	.30*	.05	.40*	.19	-.21	-.12	-.20
2		-	.10	.17	.15	-.15	.01	-.22*	-.05	.14	.15	.06
3			-	.35*	-.15	-.01	.07	.36*	.30*	-.15	-.10	-.26*
4				-	-.16	.29*	-.04	.36*	.20	-.18	-.17	-.13
5					-	-.04	.24*	-.42*	-.09	.37*	.33*	.38*
6						-	-.01	.34*	-.06	-.38*	-.19	-.18
7							-	-.04	.31*	.20	.17	.18
8								-	.34*	-.54*	-.39*	-.47*
9									-	-.06	-.15	-.16
10										-	.58*	.68*
11											-	.60*
12												-

***Note*. ZTPI = Zimbardo Time Perspective Inventory (PN = Past Negative, PP = Past Positive, PH = Present Hedonistic, PF = Present Fatalistic, F = Future); YSQ-S = Young Schema Questionnaire-Short Form (Fa = Failure, Us = Unrelenting standards, Is = Insufficient self-control, En = Entitlement); WES-S = Work Engagement Scale-Student Version (Vi = Vigour, De = Dedication, Ab = Absorption).**
$^*p < .001$
$N = 207$

Outcomes of regression analyses are presented in Tables 3 to 6. For all regression analyses, predictors were entered all at once. Four regression analyses were run – one standard logistic regression with unit completion (yes/no) the outcome variable, and three standard multiple regression analyses with each of the WES-S scales (Vigour, Dedication, Absorption) as outcome variables. Results are presented below.

Table 3: Logistic Regression Coefficients for the Prediction of Unit Completion by Cognitive Schema and Time Perspective

Variables	*B*	*SE B*	Wald Chi-square	*df*	*p*	Odds Ratio
YSQ-S Fa	0.09	0.03	8.54	1	<.01	1.10
YSQ-S Us	-0.06	0.04	2.73	1	.10	0.94
YSQ-S Is	0.05	0.05	1.10	1	.29	1.05
YSQ-S En	-0.05	0.05	1.24	1	.27	0.95
ZTPI PN	0.04	0.30	0.02	1	.89	1.04
ZTPI PP	-0.24	0.29	0.67	1	.41	0.79
ZTPI PH	0.78	0.36	4.55	1	<.05	2.17
ZTPI PF	-0.77	0.35	4.84	1	<.05	0.47
ZTPI F	-0.46	0.42	1.19	1	.28	0.63
Constant	0.75	2.33	0.11	1	.75	2.12

***Note.* Four outliers with standardized residuals > 2.5 were removed from the analysis. Odds ratios > 1.00 indicate greater likelihood of unit withdrawal.**

The full model containing all predictors was statistically significant, $\chi^2(9, n = 199) = 30.48$, $p < .001$, explaining between 14.5% (Cox and Snell R-square) and 20.9% (Nagelkerke R-square) of the variance in Unit Completion. Three of the predictors made a unique, statistically significant contribution to the model; YSQ-S Fa, ZTPI PH, and ZTPI PF. The odds ratios suggest that there was a lower likelihood of unit completion for those with higher levels of YSQ-S Fa and ZTPI PH, and higher likelihood of unit completion for those with higher levels of ZTPI PF.

Table 4: Standard Multiple Regression Coefficients for the Prediction of Academic Engagement (Vigour) by Cognitive Schema and Time Perspective

Variables	*B*	*SE B*	β	sr^2
YSQ-S Fa	-0.26	0.07	-0.26**	.05
YSQ-S Us	0.16	0.07	0.14*	.02
YSQ-S Is	-0.45	0.09	-0.40**	.08
YSQ-S En	0.02	0.09	0.02	.00
ZTPI PN	-0.22	0.58	-0.03	.00
ZTPI PP	-0.05	0.56	-0.01	.00
ZTPI PH	-0.10	0.67	-0.01	.00
ZTPI PF	0.90	0.67	0.09	.01

ZTPI F	**2.03**	**0.79**	**0.17***	**.02**

***p* < .05**
****p* < .005**

The model explained 39% of the variance in Academic Engagement (Vigour), $F(9,198) = 14.08$, $p < .001$. Significant individual predictors in the model were YSQ-S Fa, YSQ-S Is, YSQ-S Us, and ZTPI F. Higher levels of YSQ-S Fa and YSQ-S Is were associated with lower levels of Vigour, whereas higher levels of YSQ-Us and ZTPI F were associated with higher levels of Vigour. The effect sizes for all predictors were small (Cohen, 1992).

Table 5: Standard Multiple Regression Coefficients for the Prediction of Academic Engagement (Dedication) by Cognitive Schema and Time Perspective

Variables	***B***	***SE B***	**β**	***sr*^{2}**
YSQ-S Fa	**-0.08**	**0.05**	**-0.12**	**.01**
YSQ-S Us	**0.12**	**0.06**	**0.15***	**.02**
YSQ-S Is	**-0.19**	**0.07**	**-0.24****	**.03**
YSQ-S En	**-0.14**	**0.07**	**-0.15***	**.02**
ZTPI PN	**0.42**	**0.46**	**0.08**	**.00**
ZTPI PP	**-0.05**	**0.44**	**0.09**	**.01**
ZTPI PH	**0.35**	**0.53**	**0.05**	**.00**
ZTPI PF	**-0.10**	**0.53**	**-0.02**	**.00**
ZTPI F	**1.54**	**0.63**	**0.19***	**.02**

***p < .05**
****p < .005**

The model explained 23% of the variance in Academic Engagement (Dedication), $F(9,198) = 6.48$, $p < .001$. Significant individual predictors in the model were YSQ-S Us, YSQ-S Is, YSQ-S En, and ZTPI F. Higher levels of YSQ-S En and YSQ-S Is were associated with lower levels of Dedication, whereas higher levels of YSQ-Us and ZTPI F were associated with higher levels of Dedication. Again, the effect sizes for all predictors were small (Cohen, 1992).

Table 6: Standard Multiple Regression Coefficients for the Prediction of Academic Engagement (Absorption) by Cognitive Schema and Time Perspective

Variables	*B*	*SE B*	β	sr^2
YSQ-S Fa	-0.13	0.09	-0.10	.01
YSQ-S Us	0.22	0.09	0.15*	.02
YSQ-S Is	-0.39	0.12	-0.27**	.04
YSQ-S En	-0.15	0.12	-0.09	.01
ZTPI PN	-1.23	0.77	-0.13	.01
ZTPI PP	-0.61	0.74	-0.06	.00
ZTPI PH	-1.40	0.90	-0.11	.01
ZTPI PF	2.05	0.89	0.17*	.02
ZTPI F	3.73	1.06	0.25**	.04

$*p < .05$
$**p < .005$

The model explained 32% of the variance in Academic Engagement (Absorption), $F(9,198) = 10.39$, $p < .001$. Significant individual predictors in the model were YSQ-S Us, YSQ-S Is, ZTPI PF, and ZTPI F. Higher levels of YSQ-S Is were associated with lower levels of Absorption, whereas higher levels of YSQ-Us, ZTPI PF, and ZTPI F were associated with higher levels of Absorption. Again, the effect sizes for all predictors were small (Cohen, 1992).

In summary, consistent findings were apparent for YSQ-S Is and ZTPI F, with the former being a significant negative predictor of all three aspects of academic engagement, and the latter being a significant positive predictor of all three aspects of academic engagement. YSQ-S Fa was a significant negative predictor of the Vigour subscale only.

Discussion

The results partially supported the hypotheses. Future time perspective was associated with greater levels of academic engagement, as predicted, but not with unit completion. Instead, Present Hedonism (negatively) and Present Fatalism (positively) were associated with higher levels of unit completion. The cognitive schema of Failure was associated with lower unit completion rates, as predicted, but no other schemas were associated with unit completion. Failure was also associated with reduced academic engagement in terms of vigour, but not with dedication or absorption. Insufficient self-control was the only schema to be associated with all three aspects of academic engagement.

The finding that Future time perspective was positively associated with academic engagement is consistent with theory and previous research. The ability to delay instant gratification in the pursuit of future (larger) rewards is a meaningful and consistent predictor of success across many fields of endeavour, but particularly education (Freeney & O'Connell, 2010; Shoda et al., 1990). It is assumed that the mechanism by which the Future time perspective improves academic outcomes is through greater academic engagement in the short-term (see, for example, Horstmanshof & Zimitat, 2007), although this assumption has yet to be tested empirically.

The finding that Future time perspective was not associated with unit completion rates in the current study is inconsistent with previous research for all of the reasons described above. The Present Hedonistic time perspective on the other hand, was associated with lower unit completion rates, and this would appear to be consistent with the research on delayed gratification. However, Present Hedonistic and Future time perspectives are not intended to be bipolar opposites (they correlate at $r = -.29$; Zimbardo & Boyd, 1999), so the fact that Future time perspective was not associated with unit completion rates is still an inconsistent finding. Further inconsistencies with previous research were observed in the positive relationship between the Present Fatalistic time perspective and unit completion rates. Present Fatalism has been associated with lower grades in several studies (see Zimbardo & Boyd, 1999), to which the current findings are in opposition. It is possible that those with a Present Fatalistic time perspective choose to continue their studies through to completion, regardless of their early performance in the unit, due to a "devil-may-care" attitude towards their grades. This possibility may be worthy of investigation in future studies if the current results are replicated.

The finding that the cognitive schema of Insufficient self-control was associated with reduced academic engagement is consistent with theory and previous research. This schema refers in part to an "inability to restrain expression of impulses or feelings" (Young, 1999; p. 75), which would appear to be counter to the dedication and absorption required for engagement in the learning process. As well, Komarraju and Nadler (2013) reported that goal-directed effort and diligence are particularly important for academic success, and such traits would not appear to be associated with a schema characterised by a lack of self-control. The cognitive schema of Failure was also associated with a lack of academic engagement, but only in terms of the level of vigour applied to academic study.

The cognitive schema of Failure was predictive of lower unit completion rates, also consistent with theory. According to Young (1999), this schema describes people who consider themselves "incapable of performing as well as their peers in areas such as career, school, or sports" (p. 74) and who "often do not try to achieve because they believe that they will fail" (p. 74). The lack of association between maladaptive schemas other than Insufficient self-control and Failure and academic engagement or unit completion rates may be reflective of the limited set of schemas investigated in the current study. There is scope in future research therefore, to investigate relationships between academic engagement and the remaining 11 schemas not considered in the current study. In particular, schemas such as Defectiveness/Shame and Dependence/Incompetence may be more useful candidates for association with academic success than some of those chosen in the current study.

The findings concerning cognitive schemas may have implications for students in other contexts and may help to guide interventions. For example, Insufficient Self-control and Failure could be addressed with psycho-education or, in extreme cases, counselling. It has been found that understanding the influence of these schemas and then addressing them can have profound and positive consequences for improving relationships, sense of self, and self-efficacy (Young et al., 2003). This may then flow onto a different attitude to learning that is not being undermined by maladaptive core beliefs. From a pedagogical perspective, the integration of simple yet challenging educational assessments (e.g., quizzes) early in the unit may engender confidence and competence in students who present with a schema of Failure, thus decreasing the chances of these students withdrawing from the unit.

The findings concerning time perspectives may also have implications for students in other contexts. Present Hedonism in particular is not only associated with poorer academic outcomes, but also worse health outcomes including risky sexual behaviour (Rothspan & Read, 1996), substance use (Keough, Zimbardo, & Boyd, 1999), and risky driving (Zimbardo, Keough, & Boyd, 1997). In the academic context, interventions such as goal-setting, progress reviews, and practicing delaying gratification may all help moderate Present Hedonistic thinking and behaviour (Zimbardo & Boyd, 1999). Integrating goal-setting exercises into the unit learning materials may be a useful way of encouraging a shift away from Present Hedonism.

Several limitations of the current study should be addressed in future studies. Firstly, only selected maladaptive cognitive schemas were investigated in this study. In a larger sample, all 16 of the schemas in Young's model should be measured, even if only to test null hypotheses for those schemas not thought relevant to academic performance. Secondly, greater precision in students' reasons for withdrawing from the unit may help reduce some of the unexplained error in the attrition outcome measure. Asking withdrawing students to complete an exit survey is one way of achieving this. Thirdly, personality was not measured in the current study. Extraversion (e.g., Alomyan, 2004) and Conscientiousness (e.g., Poropat, 2009) have been shown to be related to academic outcomes, and may explain a proportion of the variance in relationships reported here. Finally, the small effect sizes demonstrated in relationships between time perspectives, maladaptive cognitive schemas, and academic engagement temper somewhat the strength of conclusions that can be drawn.

In conclusion, the current study has demonstrated potentially useful relationships between time perspectives, maladaptive cognitive schemas, and academic outcomes in a cohort of online students for the first time. The advantage of investigating time perspectives and cognitive schemas is that each is associated with empirically justified interventions that may help moderate cognitive biases that are counterproductive to academic success. Future studies should aim to implement such interventions and evaluate their effectiveness in retaining students in online units of study.

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Moving on from WebQuests: Are DiscoveryMissions the next big thing?

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This paper introduces a new teaching strategy called a DiscoveryMission, which builds on from and is a newer version of a WebQuest, which is a web-based learning experience for students. First year pre-service education students were introduced to the DiscoveryMission and completed one as part of an educational technology course. This paper describes a DiscoveryMission and presents initial findings of the data collected. Results include students being engaged and enjoying completing a DiscoveryMission and that they would use them in their teaching in the future.

Keywords: WebQuests, DiscoveryMissions, Pre-service teachers, teacher education

Introduction

In 1995, Bernie Dodge and Tom March introduced the concept of the WebQuest or a web-based learning experience that is "wrapped around a doable and interesting task that is ideally a scaled down version of things that adults do as citizens or workers" (Dodge, 2007). The initial idea of a webquest was to provide an inquiry orientated activity which allowed students to gain information from the Internet (Dodge, 2001). It also allows for students to engage with higher order thinking and problem solving (Dodge, 2007) through a guided experience using the Internet. Subsequent research has shown that WebQuests can be an effective way of encouraging students to engage in higher order thinking with one study suggesting this as part of an initial teacher training module (Allan & Street, 2007).

One of the great features of the WebQuest is its simplicity, in both creating them and for the learner. The WebQuest product itself as described by Polly and Ausband (2009) includes seven distinct elements:

1. Introduction
2. Task
3. Process
4. Evaluation
5. Conclusion
6. Credits
7. Teacher Page

These steps provide an easy to design template for creating web-based educational activities. Each of the elements is designed to either walk a student through a structured interaction with information on the web or provide teachers the resources they would need in order to incorporate the WebQuest into their own setting.

WebQuests can also provide a structure for teachers to scaffold students (March, 2003). In a world coming to grips with this vast amount of information available to teachers and students, the WebQuest became a hit early in the 21st Century. Thus, it is rightly seen by many as the gold standard for educational uses of the internet.

Although WebQuests are a fantastic initiative it has a major weakness that the design has not been able to overcome easily. This is that it hasn't adapted well to Web 2.0. The WebQuest is the perfect classroom application of Web 1.0 Internet tools, but it is designed to be a process that provides information to the students, even if students are creating their own WebQuests. For example, the creator of the WebQuest finds and organises all of the information that the user of the WebQuest will need. The developer envisions the task, outlines the process, creates the evaluation plan, designs the conclusion, and then provides this as a learning experience for users of the WebQuest. In this paradigm, the user of the WebQuest plays no role other than that of a passive recipient of the developer's guidance and materials, even though the tasks can be hands on and authentic. This type of one-to-many design works well in a Web 1.0 setting, but it doesn't fully leverage the capabilities of Web 2.0 technologies that easily allow creation of content. Understanding that, it is proposed that the DiscoveryMission is the natural next step in this progression.

The DiscoveryMission is a user-generated educational resource that includes the following elements:

1. Mission Goal
2. Mission Training
3. Mission
4. Mission Procedures
5. Mission Resources
6. Mission Completion
7. Mission Reflection

Specifically, these elements are broken into two broad categories that illustrate the roles of the different participants in the process of learning:

1. Teacher Lead (those elements that the teacher would identify):
    a. Mission Goal: The standards the student will meet.
    b. Mission Training: The background information that the student should have mastered in order to complete the current mission.
    c. Mission: The **specific question** the students will answer with their mission
2. Student Lead (those elements that would involve the students in designing):
    a. Mission Procedures: The instructions for students to complete their mission including getting feedback during this process.
    b. Mission Resources: Links to resources for the technology applications and/or additional content resources specific to the students' topic that can be used to complete the mission.
    c. Mission Completion: Final product. The intent is to share with parties beyond teacher and classmates.
    d. Mission Reflection: Students reflect on what was learned during the mission and how their project meets the mission goals.

The DiscoveryMission uses a student-centred, negotiated-learning approach that not only provides the opportunity for students to lead the development of learning tasks, but, in fact, requires it.

WebQuest Comparison

The DiscoveryMission has several significant features that expand beyond the capabilities of a WebQuest.

Firstly, the process itself inherently demonstrates a student-centred learning experience. The student is not passively receiving information from the teacher or the Internet. Rather, the student is bringing information into the classroom, which the teacher and his or her classmates can help evaluate and verify.

Secondly, the beginning of the DiscoveryMission can be duplicated or shared by other teachers. One of the strengths of the WebQuest model is that individual WebQuests can be shared. Once a developer has finished the creation of a WebQuest, other teachers can find that instrument and incorporate it into their own classes. This would not be the case with the DiscoveryMission because the benefit of the process is seen in the students' collection and/or creation of the content. In this case, the Mission, Goals and Training stages could be copied or modified by other teachers, but the subsequent stages would be unique within the classroom setting of the new teacher due to the fact that they would be directed either fully by the student or in collaboration between the student and the teacher.

Thirdly, the DiscoveryMission model naturally leverages the vast array of Web 2.0 technologies that are currently available and which are yet to be designed. The Mission Completion stage could involve the use of wikis, blogs, podcasts, Twitter, social networking, grassroots video or any number of other technologies that ask users to create content. Any of these tools could effectively be used to provide the content that the students organize.

Finally, the DiscoveryMission model allows flexibility in order to incorporate both formative and summative assessments of work. The Mission Procedures, Resources and Completion stages can be seen as looping so that there could be several iterations of content created by students before the process completes. As students receive feedback, they can then refine the content that they have delivered, which could then be subjected to another round of feedback (by either the teacher or fellow students). There would be no limit to how often these elements could be looped aside from the education needs of the class and the time limits imposed on the assignment.

The Underpinning Philosophy

The underpinning philosophy on which the DiscoveryMission approach has been founded is that of constructivism and constructionism, and thus the student centred classroom. DiscoveryMission's build on the WebQuest environment which used a constructivism philosophy (Allan & Street, 2007; Tuan, 2011). Additionally, the philosophy of constructionism was also instrumental in the development of DiscoveryMission. Constructionism is an outgrowth of the constructivist philosophy, in that it depends on students constructing their own knowledge. The main difference is that constructionism focuses on the end product that is being developed as part of the process. Seymour Papert (Wikimedia Foundation, 2013), when defining constructionism, said that:

> (T)he word constructionism is a mnemonic for two aspects of the theory of science education underlying this project. From constructivist theories of psychology we take a view of learning as a reconstruction rather than as a transmission of knowledge. Then we extend the idea of manipulative materials to the idea that learning is most effective when part of an activity the learner experiences as constructing a meaningful product.

In a real sense, constructionism is constructivism in practice. Thus the DiscoveryMission pedagogy is designed specifically to demonstrate a way through which students can be put in charge of, or possibly be given a starring role in the development of their own educational experience.

The DiscoveryMission idea is founded by the notion that teachers can start the process of learning by giving their students a mission, and then have the students decide the direction by which they complete that mission. By letting students propose the procedures through which they would complete the mission, identify the resources that they need along the way, and identify the form of the completed product, the DiscoveryMission process empowers each student to take ownership of this process and thus the teacher can provide guidance rather than the content.

Methodology

Approximately 300 first year pre-service teachers were enrolled in an educational technology course. Most students enrolled are studying to be secondary teachers while a small number (n=17) were enrolled in a primary or 'middle years of study' course, which means that they will become either primary school teachers or middle years teachers at the completion of their four year course.

The DiscoveryMission was integrated well into the course in both the lecture for one week of the course and that same week's tutorial class. The week's classes were called 'Wikis, WebQuests and Collaborative learning' and prior to the lecture the students were required to watch a six minute video. This incorporated the above topics and included the co-author telling the students about DiscoveryMissions. During the interactive lecture the topic was further expanded upon and students were asked the question "how might you use a DiscoveryMission in your subject area"? The students reported their answers in the discussion area of their learner response system, Top Hat Monocle.

There are 15 tutorial classes held each week with approximately 20 students in each. These sessions are held in two teaching laboratories containing a computer for each person. In the tutorial class students were given a scenario based on completing a DiscoveryMission. This scenario is described here:

- Mission Goal: Students will be able to make appropriate technology decisions concerning effective delivery of content in a Queensland public school.
- Mission Training: The Queensland public school system is a large one that attempts to provide enough ICT to its students across the state. However, not everything is able to be provided to meet individual class and student needs.
- Mission: You have been awarded a $10,000 - $20,000 grant to utilize technology to deliver academic content to secondary school students at your school. However, you can apply for a top up grant of up to $500,000. What technology would you use, why and how? Design an appropriate plan for delivery that content.

There were four students in each group, with one student acting as the 'teacher' in each group and they got to make up any rules regarding any questions about the mission. The three students in each group were then asked to work through the mission. Each group then reported on their class group Blackboard discussion board the responses to the DiscoverMission. This meant that all groups in each class could access this and they could comment if they wished.

As described below data were collected in several ways from the students who attended the lecture and/or tutorial class. These included through the learner response answers recorded by the students in the lecture as well as through the completion of the DiscoveryMission responses in Blackboard (from the tutorial). One week after the tutorial the students in the course were asked to complete a questionnaire on their experiences during the DiscoveryMission tutorial class. The questionnaire was completed at the beginning of the next tutorial class. Questions included asking the students if they watched the video prior to the lecture, and what they liked about completing the DiscoveryMission as well as the asking the students to record the reasons why or why they would not use a DiscoveryMission with a future class.

From the 291 students enrolled in the course there were a total of 190 students who responded to the survey. Students were asked what steps they took in the development process of the DiscoveryMission and if they were the 'teacher' in the group. The students were also asked if they had any difficulty understanding the purpose of the DiscoveryMission elements. The student responses were analysed for a positivity and negativity split for each individual response. Data were also analysed using coding to elicit themes that were emerging.

Results

Students were asked if they watched the video prior to attending the lecture, with 75% of the students who responded (N=120) stating they did. Of these students 69% of respondents felt that watching the video helped them to understand the DiscoveryMission process.

With regards to the question of 'what did you like about completing a DiscoveryMission' just under 11% of the responses were negative and almost 90% of the written comments were positive in tone. One student commented:

> It was a great idea that gave us a real life, practical purpose for us to complete the mission that was directly relatable to something we may face in our careers. The information provided was useful and I liked that we had roles within groups and that we also worked in groups to support each other with ideas.

The students were then asked 'why or why wouldn't you use DiscoveryMissions with your class'? Fewer than 18% of comments were negative, and another 14% were ambiguous (meaning they had both positive and negative elements). That means that nearly 70% of comments were strictly positive in tone. One student stated:

> I was finally able to understand discovery mission's in the hands on application in tutorial. I'm a kinaesthetic learner... I liked that the students are able to engage so thoroughly in conversation to get to the final solution to the posed question. I think this method of teaching also allows students to investigate and pose idea's the teacher initially didn't see as a possibility.

Other student comments include:

Interactive and engaging for students, another tool for teachers to generate interest, class discussion and conversation.

The level of student contribution as the Mission is largely student directed. Also that the process can be applied to mostly anything so it is a versatile tool.

They make you feel as though you've accomplished something and they are a concrete way to assess learning. Also the task was ambiguous so there were different interpretations on the Mission which lead to some great creativity amongst groups and lots of different responses.

Conclusions

This research involved using the newly developed DiscoveryMission with pre-service education students to explore in the tutorial classes of a first year education technology course. Initial analysis of the student results were positive, and indicate that the students who participated felt the DiscoveryMission process to be worthwhile. Additional qualitative analysis of the written comment will be done to determine what specific themes and trends can be seen within the different answers..

Previous research on WebQuests suggest that these increase student engagement and promote higher order thinking (Allan & Street, 2007). Initial data analysis suggests this is also true for the new DiscoveryMission.

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Business student's attitudes to criteria based self-assessment and self-efficacy

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Reducing student passivity and designing reflective skills into tasks contributes to developing student's professional judgment capabilities (Boud, 2000). This study analyses Business student attitudes and practices related to self-efficacy, self-regulation, assessment and self-assessment in two courses where students practiced criteria level self-assessment. A survey instrument was developed and an exploratory factor analysis in both sampled groups showed broad consistency in factor identification and reliability. Both cohorts' evidenced similar presentations related to self-efficacy, positive associations with socially mediated learning and a positive attitude towards developing better professional judgment. Student's confidence in their ability to understand task level requirements and instructions was greater than their confidence in their ability to accurately judge against criteria. A significant number of third year undergraduate students reported they had few opportunities to do self-assessment activities as part of their degree. This highlights the need to better integrate self-assessment practice into our Program design.

Keywords: student attitudes to self-assessment, self-efficacy, professional judgment formation

Introduction

The context for this study is two tasks conducted in a postgraduate and an undergraduate Business School course where students did optional self-assessment against criteria. Review, online-marking software, was used to mark against the task criteria, provide feedback and collect student self-estimates against the criteria. This paper reports on student attitudes, self-regulation, experience and confidence related to assessment and self-assessment in criteria based tasks in two selected courses in the Australian School of Business (ASB), University of New South Wales (UNSW).

A strong sense of self-efficacy and robust self-regulatory mechanisms are synonymous with successful independent learners. Strong self-efficacy in learning contexts predisposes students to persist with difficult tasks and maintain and develop strategies that assist success. Learners with high self-efficacy will have high levels of perceived agency in tasks and are predisposed to cognitively engage with their learning. Cognitive engagement is a reinforcing process that assists learners to know better how to learn and provides critical frameworks for reflecting on what they do and don't know (Zimmerman 2000).

This research is informed by Bandura's social cognitive theory, which describes social, cognitive, and environmental inputs to individuals learning and development (Bandura 1994). Bandura's theories made a profound contribution to learning theory, educational approaches, psychology and organizational management. Central to the understanding of social cognitive theory is the role of self-efficacy, which is people's belief in their ability to succeed in specific situations (Luszczynska 2005), which supports motivation and success in learning. In relation to developing self-efficacy, Bandura describes determinants that promote developing self-efficacy including previous successful (mastery) experiences (which involved challenges), the examples of significant models (e.g. teachers), by social inputs that encourage success and by affective factors that contribute to or inhibit learning (Ramachaudran 1998).

In this research, a particular focus is drawn on the relationship of self-efficacy and the predisposition towards and formation of accurate professional judgments in a discipline. In this particular sub-field, previous research into learner over-confidence and inaccurate self-assessment, starting with Dunning and Kruger's (1994) studies on novice learners, has been instructive. Studies by Garavalia (2003) and Hacker (2008) on calibration and Pajare's work on self-efficacy beliefs in academic settings (1995 and 2002), among others, were referenced to map out the landscape that informs this research.

Self-efficacy has a profound impact on individual learner's engagement with learning, perseverance, and reflection (cognitive engagement). From the point of view of Educators, a key Graduate Outcome is the learner's development of these critical and reflective learning skills. As students progress through Degree programs, they are at least tacitly expected to be approaching a state of proficiency, or even 'expert' status in their field. A necessary component of expertise is the development of accurate judgment. Recognizing what constitutes quality in domain knowledge, skill or performance is a foundational professional attribute. The ability and predisposition to critically judge one's own work and the work of others should be a key skill that is developed in undergraduate education. However there is evidence that the development of self and peer assessment skills is haphazardly applied throughout the mosaic of course curriculum that aggregate into degrees. (Berzins 2008)

The development of student's critical and reflective skills is best achieved through repeated, explicit and embedded use of a range of student and learner centered authentic assessment tasks through the course of study, starting in first-year (Leamnson 1999). Regular use of tasks that scaffold, develop and allow or require students to test their ability to form accurate judgments, are the operational method to develop the challenging success experiences Bandura described (1994). In practice, these can include reflective writing tasks, student developed assessments, self-directed and self-reported tasks, and peer and self-assessment activities. Scaffolding student's understanding of what constitutes quality through embedded reflective activities that employ exemplars, rubrics and criteria that contextualize and make explicit the essential building blocks that 'break down' the key components of what 'quality' looks like, makes comprehensible to students why a D (Distinction grade) is a D.

Sadler (2010) describes key processes in the formation of expert judgment and notes the necessity of moving students from consumers of marks and feedback to active participants and judges in tasks and assessment. This requires systematic assessment design that builds opportunities for students to practice and test out their developing judgment skills. 'A defining characteristic of any profession is that it depends on the wise and effective use of judgment and knowledge...' (Angelo and Cross in Dunn, 2002). Student self-assessment is part of a suite of practices that helps students form a predisposition to rigorous critical and reflective practice. One of the clear developmental roads to achieving accurate holistic judgments is the practice and development of accurate discipline oriented judgments against criteria, although as Regehr (2006) notes, there are inherent challenges in accurate self-estimations. While Lew (2010) finds that there is no relationship between student beliefs about the utility of self-assessment practice and their self-assessment accuracy, there is a counter argument that even where student self-assessment accuracy does not demonstrably improve, that the engagement with reflective processes can encourage cognitive insight and gains (Basnet 2012; Regehr, 2006). Despite the challenges, the development of accurate judgments of oneself and others is arguably a critical graduate learning outcome.

Embedding meaningful, well-constructed and frequent self-assessment activities in assessment tasks is likely to promote both a social learning culture of and individual's predisposition towards practicing critical and reflective thinking skills in a systematic way. In particular, integrating self-assessment activity with online tasks in 24/7 systems allows learners to record their self-assessment judgments at any time, at the learning moment, whenever that is. The ability to make initial judgments and update them (anywhere, anytime) as the student's engagement and critique develops, is a powerful affordance of online self-assessment.

The wider use of embedded reflective activities such as self-assessment can change student's experience of assessment. The potential for reflective approaches including self-assessment to increase student engagement with course learning goals and assessment are clear (Gibbs, 2004). Indeed, the ideal outcome is for our assessment to do double duty: to both serve the needs of certification and of learning (Boud, 2000).

Context of study

The long-term research plan seeks to identify relationships around self-efficacy, student attitudes to assessment and self-assessment accuracy in student Business School cohorts and if there are measurable or self-reported effects of teacher interventions designed to improve student self-assessment accuracy. For the purpose of this paper (which represents an introductory stage of the research project), the focus is constrained to an early examination of student attitudes related to self-efficacy, self-regulatory behavior, self-assessment and confidence in their domain judgments and socially based learning, in a first year postgraduate and third year undergraduate course in the ASB at the University of New South Wales.

Lecturers in Charge (LICs) of two courses (one postgraduate, one undergraduate) hosted an ethics approved study to promote student self-assessment practices, survey students on their attitudes to self-assessment and self-efficacy and analyse the relationships between student course outcomes (task and final course grades) and their self-assessment accuracy and practices. These latter results will be reported on in detail in a separate paper.

Both courses marked two tasks through Review where students were encouraged to do self-assessment. The software allows staff to mark and comment against criteria and for students to self-assess their work against the same criteria. Students can self-assess more than once and were encouraged to use the self-assessment process to check progress to task and criteria fulfillment. The criteria judgment can be placed at any point on a visual slider scale for each criterion, which indicates a point on the University grading scale 0-49 Fail (F), 50-64 Pass (P), 65-74 Credit (C), 75-84 Distinction (D), and 85-100 High Distinction (HD). The staff marks and student self-assessment predictions are stored in a centralised database and can be downloaded for analysis.

Methods

The overall research plan employs a mixed methods design to investigate student attitudes, practice and accuracy in criteria based self-assessment. Components of the design include the opportunity to do embedded self-assessment (in Review), optional participation in surveys, interviews, lecture visits, supportive reinforcement emails and encouragement from the lecturers and a small number of in-class exercises (conducted by tutors) to encourage students to discuss self-assessment and improve their self-assessment accuracy.

This paper focuses on analysis of survey data from the two cohorts relating to student attitudes to self-assessment, their confidence in self-assessment in task and criteria fulfillment and their self-regulation, experience, their self-regulation activity and their experiences with assessment.

Factor Analysis Process:
An exploratory factor analysis was conducted to reduce the data set to a smaller number of correlated variables and identify latent relationships and themes in the surveyed data and population. Data from the surveys was collated in Excel; missing or uninterpretable variables were coded as missing. The coding design was verified prior to importation into SPSS (a statistical analysis software) and the one negatively worded item (item C22 survey1 and C23 survey 2) was reverse coded. Principal axis factoring with orthogonal (Oblimin) rotation was chosen for the first interrogation of the data, as this is a new instrument and no theoretical presupposition was placed on interpretation (Field 2009). The ordinal values in each survey were loaded as variables; missing values were excluded listwise and the analysis was set to sorted by size and small coefficients were suppressed at an absolute value <.30.

The regression method was chosen because correlation between scores was both acceptable and expected. When the Factor Analysis was run, a check for Eigen values greater than 1, and a check for excessive collinearity (greater than .9) in the Correlation Matrix were completed. The KMO statistic was above 0.7 in the analysis of both data sets and this is acceptable (Field 2009) for a sample of this size (Kaiser 1974). Bartlett's test of Sphericity was significant at <.001. In conclusion, while the samples are small, tests of sampling adequacy showed they were acceptable.

Table 1: Survey sampling adequacy tests

Survey 1: KMO and Bartlett's Test		Survey 2: KMO and Bartlett's Test	
KMO Measure of Sampling Adequacy.	.777	KMO Measure of Sampling Adequacy.	.865
Approx. Chi-Square	718.04	Approx. Chi-Square	1973.51
Bartlett's Test of Sphericity df	136	Bartlett's Test of Sphericity df	171
Sig.	.000	Sig.	.000

The extraction Method was Principal Axis Factoring, Rotation Method was Oblimin with Kaiser Normalization

In both surveys, the Eigen values and scree plot were checked and potential viable factors were identified. The pattern matrix was scanned and items with low communalities and weak or cross factor loadings (under .4) were noted for deletion. The KMO figure was checked on item deletion and strengthened throughout this process. The factor scores in the pattern matrix table were reviewed and the values were deemed acceptable. Deletion of items was stopped when a clean and interpretable factor set was found and a review of all the tables conducted. Sample sizes were noted as was the total variance of each factor after extraction. Reliability analysis was then performed on all the scale items of each factor and the Cronbach alpha scores and significance were checked and found acceptable in each instance, indicating the reliability of the factor and sub-scale items.

Instrument
An original survey modeled on existing standardised survey instruments was developed for this study into student's attitudes and practices related to assessment and self-assessment. Standardized instruments referenced in the development of this scale included Albert Bandura's Guide for constructing self-efficacy scales in Self-Efficacy Beliefs of Adolescents (2006), the 'Motivated Strategies for Learning Questionnaire', Zimmerman's structured interview for assessing student use of self-regulated learning strategies (1987) and Scherbaum's critique of the validity of generalised self-efficacy scales, were referenced in the construction of the survey instrument (2006).

The items on the test were organized into five sections, an introductory demographic section (6 items) and a question (A7) on student's final course mark prediction. The other items (questions 8 to 34 in the postgraduate survey and 8 to 37 in the undergraduate survey) were grouped in four sections titled 'Self-efficacy for self-regulated learning', 'Self-efficacy for socially mediated learning', 'Self-efficacy for learning and judging' and 'Attitudes about learning'. The second survey iteration (with the undergraduate group) saw the deletion of one item, introduction of four new questions and a number of minor rewordings. For this reason, references to item (question) numbers between the surveys do not exactly match in all cases.

Non-demographic questions were positively worded and presented as 5 point likert scale with 1 representing strongly disagree, 2, disagree 3 neither disagree nor agree, 4 agree and 5 strongly agree. The final question in the undergraduate survey was an open-ended response on the experience of doing self-assessment against criteria. The anonymous survey was distributed in paper based format at postgraduate lectures (with completion rates being high) and via an anonymous online survey to the undergraduate cohort (with acceptable completion rates).

Process
Two surveys were conducted with a first-year postgraduate and third-year undergraduate cohorts. The first survey was made available early in semester and the second immediately after the final assignment task and just before the exam period. The conduct and results of each initial survey in each cohort is reported on.

The first survey was conducted after students had a ten minute introduction (at lectures) on the reasons for doing self-assessment in tasks, had had a short (ten minute) socially based class activity conducted by their tutors, and had access to Review to do self-assessment in their first task (details below). The purpose of these inputs was to activate their thinking about the utility of self-assessment as a useful activity related to their learning and as an encouragement to meaningfully do the self-assessment in their assessment tasks.

The information at lectures included practical details on how to access Review, how to enter their self-assessment estimates, conditions of the study (participation in surveys was voluntary and did not affect course grades) and feed-forward of the criteria accuracy experience of previous cohorts at UNSW. The feed-forward also contained references to elements of theory related to optimism biases (Dunning and Kruger 1999, and Dunning, Heath and Suls, 2004,) and observations on local practice. Related to theory, slides with data presenting the optimistic self-assessment of weaker students and the under-estimation estimates of stronger students were presented. Relating to local practice, we showed similar data from previous cohorts with examples of over-optimistic student criteria and task self-assessment and performance gaps (against actual performance).

As part of the feed-forward process, students were advised in the lecture and via a summary email to avoid over-optimistic or aspirational self-assessment. Specifically to control for the misconception that over-optimistic self-assessment might influence markers to inflate their mark, students were informed that their self-assessment estimates were only visible to markers after marking was complete and therefore high self-estimates couldn't influence the markers judgment.

The socially based class activity was a ten to fifteen minute group based discussion in tutorials, analyzing the criteria and discussing peer's approaches to fulfilling the task. This simple task operationalizes the social constructivist learning theories advanced by Bandura. One of the causes of learning changes and developing self-efficacy in individuals are the positive influences of significant models and social mores which students identify with. These reinforce actions they feel are achievable (Pajares, 2002). In domain specific educational contexts, this can be realized by lecturers and tutors (significant leaders) making time for socially mediated activity where individuals share and focus their thoughts on task deconstruction, criteria interpretation, task regulatory approaches and discussions around quality. Clearly, the goal is both to encourage deeper cognitive engagement with key elements of the task and the potential for affective factors (social and personal identification) to reinforce students' self-efficacy, engagement and persistence. (Bandura, 2001).

Survey one: first year postgraduate cohort

Ninety six of one hundred and thirty one students in a first year postgraduate course (semester 2, 2012) were voluntarily surveyed, 59.4 % were females and 40.6% males. 74% of the students were under 25 years of age and 75 % of the students self-reported that they were internationals. Chinese nationals represented the largest grouping (47.9%) followed by Australians (19.8%), then Indonesians (9.4%). 85.4 % of students reported that English was not their first language.

In relation to expected final mark (question B7) for the course, 32.3% predicted they would achieve a HD, 55.2% expected a D grade, 11.5% expected a C, and only 1% of students reported expecting to get a P. No students reported that they expected to receive an F on the course.

Four factors accounting for 55% of the total variance were presented as interpretable due to the strength of the values indicated in the final Pattern Matrix. The items also exhibit theoretical soundness as factors in relation to existing literature in self-efficacy, self-regulation and confidence in self-assessment in academic performance (Falchikov 1989). Negative values were noted in the column for Factor 2, but as these values were based on strongly positive mean scores in all cases, this was not interpreted as implying directionality, and a negative construct was not inferred; the negative value was seen as a result of the rotation process. (Walker 2012).

Factor 1:
Factor 1 was named 'Student confidence in understanding task and criteria' and item loadings that comprise the factor were D24 'I understand what the teacher wants me to produce in the assessment task', .893, D23 'I understand what the assessment questions means for this task', .847, D25 'I understand the meaning of the criteria I'm being assessed against in this task', .527 and D26 'I am confident I can accurately self-assess my work against these assessment criteria' .424.

Factor loading decreases from general understanding and confidence in understanding the requirements of the task and the task directions, to lower scores in comprehension of the criteria to the lowest score relating to student's confidence in their ability to accurately self-assess against the criteria (D26). Of the four factor items, this item also had the lowest mean score of 3.7 (out of a possible maximum score of 5). While this is well above the mid-point (2.5), it shows less certainty and confidence on this sub-skill. Despite some cross-loading onto Factor 4, D26 was retained as it enhanced factor comprehensibility. Reliability analysis on the sub-scale items returned a Cronbach alpha of .804 indicating the reliability of the factor set and this was significant at p = <.5.

Factor 2:
Factor 2 was named 'Student identification with the utility of socially based learning'. The scale items were C20 'Discussing how my classmates approach, plan and do their assessments is very useful' -.825, E31 'Discussing a task with others helps me to understand the task better' -.812, E28 'I think studying with others is a good way to learn', -.748, C19 'Discussing assessment tasks with classmates helps clarify the assessment requirements' -.731, and C17 'I like to discuss assessment tasks with classmates' -.587. The items all relate to student identification with the usefulness of learning with others. The first four items demonstrate that students perceive a strategic advantage in using the expertise of their peers to prepare for assessments. The weakest item, C17 is related to their feelings around socially based learning, 'I like to discuss assessment tasks with classmates'. The items of this factor returned a Cronbach alpha of .865 indicating reliability and was significant p = <.5

Factor 3:
Factor 3 was named 'Student identification with the utility of self-assessment practices' and the items were E29 'I think practicing self-assessment accuracy is useful' .783, D27 'Practicing self-assessment (in assessment tasks) regularly, is likely to lead to improved professional judgment' .726, E34 'I want to develop better self-assessment judgments' .626, E33 'Developing accurate professional judgment is as important as being judged

by teachers / experts' .486. The strongest items relate to the usefulness of practicing self-assessment and the likelihood that practicing self-assessment would likely lead to improving professional judgment. On these items the postgraduate group was more positive about the positive impact of practicing self-assessment than their undergraduate peers (see Table 4). Students surveyed are predisposed to developing better self-assessment judgments (E34). The weakest factor item by average score was E33, 'Developing accurate professional judgment is as important as being judged by teachers / experts'. The items of this factor returned a Cronbach alpha of .756 indicating reliability and was significant p = <.001.

Factor 4:
Factor 4 was named 'Student use of feedback and self-regulation'. The items were B16 'When I receive feedback, I usually consider how I can apply it to future tasks' .738, B15 'When I receive feedback, I usually read it carefully'.715, B10 'I check the task instructions and requirements more than once while completing the task' .517, B16A 'When doing a new assessment task, I usually think about the feedback from past assessments'. The strongest items relate to referencing current task feedback to future tasks (B16) and students assertion that feedback is diligently considered (B15). B10 refers to self-regulatory tasks processes and B16A (the weakest item) asserts that students think less about earlier task feedback when doing new tasks. Descriptive statistics for these items returned high means, 4.23, 4.38, 4.28 and 3.97 (out of 5) respectively. Again, incorporating feedback from earlier tasks (B16A) recorded the lowest mean level of agreement of these items. The Cronbach alpha of .743 indicated factor reliability and was significant at p = <.001.

Survey two: third year undergraduate cohort

One hundred and nineteen of six hundred and twenty two enrolled students voluntarily responded to the online Blackboard survey in the third year undergraduate course (semester 1, 2013). 61.3 % were females and 38.7% males. 98.3 % of the students were under 25 years of age. 52 % of students reported as locals and 47 % of the students self-reported as internationals. Chinese nationals represented the largest international grouping (33%) Notwithstanding the higher representation of local students, 68.1 % of students reported that English was not their first language, indicating the multi-cultural composition of our local student population.

25 students responded to the open-feedback question. Responses were grouped thematically on attitudes to self-assessment and were marked on-topic, then subdivided into negative, positive, observational (neither positive nor negative) and off-topic (course feedback and comments on the survey). Of the on-topic responses, 11 comments were positive, 1 was negative and there were 5 general observations and comments on self-assessment (e.g. 'I need to develop better self-assessment'). 8 responses related to comments on the course and the survey itself, The 1 negative commentator saw the activity as 'an easy way for uni teacher (sic) to do less work'. Far more students were favorable however, and comments included 'Self-assessment is very important for us to improve … but hard to do at the beginning. I would like to have some more instructions about how to do it' and 'This is the first time I've completed a self-assessment survey and it has certainly helped me think about what it is I'm doing and how I can better approach not only this assessment but more assessments in the future'. In a nod to the way Review scaffolds embedded student self-assessment and the provision of criteria based feedback was the affirming comment, 'I wish learning technologies like these could be used in other courses as well'.

An examination of the pattern matrix, sums of squared loadings column and the scree plot showed there were three strong factors and one weaker one; the four factors accounted for 69.6 % of the cumulative variance on extraction.

Factor 1:
Factor 1 was named 'Student confidence understanding task and criteria and utility of self-assessment' and included most of the scale items identified in factors one and three of the previous years' postgraduate survey. The items comprising the factor and their factor loadings were D27 'I am confident I can accurately self-assess my work against these assessment criteria', .900, D25 'I understand what the teacher wants me to produce in the assessment task' .884, D24 'I understand what the assessment questions means for this task' .832, D26 'I understand the meaning of the criteria I'm being assessed against in this task' .808, D29 'I have a lot of experience of doing self-assessment of my own work' .724, D28 'Practicing self-assessment (in assessment tasks) regularly, is likely to lead to improved professional judgment' .692, B14 'I am confident I can successfully complete course related tasks' .650, E31 'I think practicing self-assessment accuracy is useful' .606 and E33 'Developing accurate professional judgment is an important skill' .428.

Item D29, 'I have a lot of experience doing self-assessment of my own work' scored the second lowest mean score (3.18 out of a maximum possible score of 5) in the descriptive frequencies table. Surprisingly for a third year cohort, only 29.3 % of students reported they had had a 'lot' of self-assessment practice. The 66.4 % non-positive response (strongly disagree, disagree and neutral) was the largest negative response for any single survey question. This disturbing response from final-year students reveals that self-assessment activities are not widely practiced in our student's current course of study.

Again, in contrast to this, the factor items evidence strong positive student identification with the usefulness of self-assessment activity and their belief that practicing it can assist in developing sound professional judgments (D28, E31 and E33). Item E33, 'Developing accurate professional judgment is an important skill' recorded the highest mean survey score; 4.58 out of 5. When a reliability analysis was run on the sub-scale items it returned a Cronbach alpha of .948 indicated excellent reliability of the factor set which was significant at p = <.5.

Factor 2:
Factor 2 was named 'Student identification with the utility of socially based learning' and was the same as factor 2 in the postgraduate survey, including most of the same items. The items comprising the factor were C21 'Discussing how my classmates approach, plan and do their assessments is very useful' .821, C20 'Discussing assessment tasks with classmates helps clarify the assessment requirements' .802, C17 'I like to discuss assessment tasks with classmates' .625, C23 'The opinions or examples of my class mates influences the way I prepare for assessments ' .567.

Overall, the items show strong student identification with the utility of socially based learning. The item C20 'Discussing assessment tasks with classmates helps clarify the assessment requirements', scored 66.4 % agreement, the highest positive item score in the survey and C21 'Discussing how my classmates approach, plan and do their assessments is very useful' scored 58.6 % agreement.

The weakest factor item was C23 (see above) student survey raw survey scores showed that 38.8 % answered positively (strongly agree or agree), 43.1 % were neutral, and only 18.1% felt they were not (disagree and strongly disagree) influenced by peer example. So, while the students readily recognize the utility of socially based preparation around assessment, a smaller number of students recognize an influence or change in their own practice as a result of it. The reliability analysis on the sub-scale items returned a Cronbach alpha of .734 indicating the reliability of the factor set which was significant at p = <.5.

Factor 3:
Factor 3 was named 'Student observations on learning' although a clear interpretation for a unifying theme in this factor is challenging. The items identified were B12 'I am easily discouraged when I do difficult tasks' .710, E36 'I find it difficult to be critical of my own work.' .584 and B19 'Learning is primarily an individual activity' .533.

The student's survey responses of these items show evidence of persistence. Item B12 showed a slightly negative kurtosis in responses to the question 'I am easily discouraged when I do difficult tasks', indicating that students felt they persevered when faced with difficult tasks. 35.3% replied negatively, indicating they considered themselves resilient, 38.8% were neutral and 25.8% indicated they were easily discouraged. On E36, 41.4 % of students either agreed or strongly agreed with the statement 'I find it difficult to be critical of my own work'. Student responses to item B19 'Learning is primarily an individual activity' were evenly divided; 38.8 % of students agreed, 29.3 % were neutral and 31.9 % disagreed. That such a large percentage of students felt that learning was a socially mediated activity was encouraging. Reliability analysis on the sub-scale items returned a Cronbach alpha of .802 indicating the reliability of the factor set which was significant at p = <.5.

Factor 4:
Factor 4 was named 'Student use of feedback and self-regulation' and was consistent with factor 4 from the postgraduate survey. This factor comprised the items B16 'When I receive feedback, I usually consider how I can apply it to future tasks' -.805, B15 'When I receive feedback, I usually read it carefully' -.767
B17 'When doing a new assessment task, I usually think about the feedback from past assessments' -.698. The strongest factor loadings relate to referencing current task feedback to future tasks (B16) and students assertion that feedback is diligently considered (B15). B10 refers to self-regulatory tasks processes and, consistent with the postgraduate survey, students thought less about earlier feedback when doing new tasks than applying feedback to future tasks (B17).

The descriptive statistics of these factor items show the percentage of students who responded strongly agree or agree for B15, was 87.9 %, B16, 68.1 % and B17, 62 %. The strong negative skew (bias to the positive values) on B16 and especially B15 is evidence that students do read feedback and report positive behaviors relating feedback to future task accomplishment. The factor's Cronbach alpha was .868 and it was significant at $p = <.5$

Results and discussion

Exploratory factor analysis of both populations showed broad consistency in factor identification, the sub-scale items and factor reliability. Further refinement and testing of this instrument into student attitudes to self-assessment and self-efficacy with other cohorts, larger sample sizes and different contexts is required to confirm its validity. Both postgraduate and the undergraduate cohorts evidenced high degrees of self-reported self-efficacy, strong positive associations and identification with socially mediated learning and positive attitudes towards development of critical and self-reflective skills. Confidence in their self-assessment ability was reported in both. Somewhat surprisingly, the third-year undergraduate group provided less realistic course grade outcomes than the postgraduates, many of whom were recent arrivals. Several possible explanations exist, and apart from the cases of rising expectation and harder grading in final year courses, we have observed a general plateauing of student third year mark averages; it seems that final year undergraduates economies their effort and while confident of their ability, more students cruise to some extent in this year.

In relation to expected final mark for the course, the predictions of third year students were less inflated than those of the postgraduate group (more of whom were recent arrivals in Australia). Only 14.3 % (versus 30.1%) predicted they would get a HD and a larger number of postgraduates (57% versus 50.4%) predicted a D. Undergraduates more realistic projections of a C (credit grade, 31.1 % versus 11.8% undergraduate), is likely informed by calibration of recent grade experiences but still retains an overly optimistic bias. Very few students predicted getting a Pass and (unsurprisingly) no students in either cohort predicted they would fail.

Table 2: Question A7 – undergraduate and postgraduate students predicted and actual course grades

	Third year undergraduates (surveyed, n = 119)		First year postgraduates (surveyed, n = 93)	
Grade	**Percentage grade predicted**	**Percentage actual grade**	**Percentage**	**Percentage actual grade**
F	0	5.12	0	1.04
P	3.4	48.20	1.1	25.77
C	31.1	27.90	11.8	48.45
D	50.4	10.22	57.0	20.62
HD	14.3	8.56	30.1	4.12
Invalid	.8	0	0	0
Total	100.0	100	100.0	100

In the mean scores in both surveys, students expressed slightly less confidence in their ability to accurately self-assess themselves against known assessment criteria in a task than other related items (see Table 3 below). Both cohorts recorded higher mean scores for the items D24 to D26, which related to more general understanding the task requirements, task criteria and their general confidence in fulfilling tasks in their Programs. Lower confidence in self-assessment accuracy against criteria could be associated with a number of causes. One cause is the lack of frequent opportunities to practice self-assessment and calibrate (and gain confidence in) their criteria accuracy judgment, which students referred to. Another cause could be an interference factor, from general (over) confidence and their strong sense of generalized self-efficacy, which dilutes as students consider more precise and practice-based task /discipline items. In any case, students' high level of confidence in their self-assessment accuracy was not matched by accuracy in either their course final grade prediction or their criteria self-assessment estimates (discussed in a future paper).

Table 3: Student average response scores on task comprehension and criteria confidence

	D24 I understand what the assessment questions means for this task	D25 I understand what the teacher wants me to produce in the assessment task	D26 I understand the meaning of the criteria I'm being assessed against in this task	D27 I am confident I can accurately self-assess my work against these assessment criteria
postgraduate survey	3.82	3.77	3.89	3.7
undergraduate survey	3.76	3.57	3.7	3.28

Score is the mean score of all respondents out of a possible 5 (mid-point is 2.5)

It's interesting that postgraduate students showed a more negligible difference (possibly evidence of general over-confidence as many were recent arrivals). In contrast the third year undergraduates reported a lower mean confidence score on D27 (ability to accurately self-assess against criteria) and, despite nearing graduation, they reported the second lowest mean statistic response (3.18) of the survey on item D29, 'I have a lot of experience doing self-assessment of my own work'. The low score on D27 exists in sharp contrast to the undergraduate's response on E33, 'Developing accurate professional judgment is an important skill', which at 4.47 agree, was one of the highest averaged scores in the undergraduate survey.

This evidence of how the students value the development of professional judgment skills and the patchy integration of course embedded self-assessment practice in this degree, points to a need to more systemically embed foundational reflective practices into program designs. Nulty (2011) observed the importance of the explicit introduction of these practices from the start of the undergraduate program. The foregrounding of the development of reflective / professional judgment attributes and its realization through frequent, course-embedded use and socially based discussion would create a learning culture predisposed to reflective practice.

Both cohorts returned similar mean scores and rated the aspirational item E35 'I want to develop better self-assessment judgments' and the identification with the construct in item E33, 'Developing accurate professional judgment is an important skill' as the highest average score items in the set of questions on the practice and utility of self-assessment (see Table 4). Both groups reported E34 'Developing accurate professional judgment is as important as being judged by teachers / experts' as the third highest item score. This indicates a strong positive orientation in the third year and first year students to learner independence and self-regulation.

Table 4: Student average response scores on self-assessment practices and utility

	D28 Practicing self-assessment regularly, is likely to lead to improved professional judgment	E31 I think practicing self-assessment accuracy is useful	E33 Developing accurate professional judgment is an important skill	E34Developing accurate professional judgment is as important as being judged by teachers / experts	E35 I want to develop better self-assessment judgments
post-graduate survey	3.94	3.98	4.26	4.06	4.37
under-graduate survey	3.57	3.51	4.47	4.03	4.26

Score is the mean score of all respondents out of a possible 5 (mid-point is 2.5)

Both groups evidenced strongly positive responses to socially mediated learning; they report enjoying and being informed by peer contact. Only 18.1% of the undergraduate students felt they were not influenced by peer example while 38.8 % answered strongly agree or agree, indicating that a significant number of students do feel they change their behavior through the influence of peer's practice and examples related to assessment.

Conclusions

The consistency of the factors and factor items identified in results with the two student groups suggests that further confirmatory tests should be conducted with other cohorts to confirm the validity of this instrument to assess student attitudes to confidence in self-assessment and the utility of socially mediated learning. The evidence in this study reveals that large numbers of final year undergraduate students in the surveyed course feel they haven't had frequent opportunities to practice self-assessment. As the practice of self-assessment is a foundational professional skill in the development of critical and reflective approaches, this situation is illuminating for our institution and relevant for accreditation and regulatory bodies and Program Directors. Higher Education leaders and employer groups are increasingly focused on embedding the formation and development of graduate capabilities, such as critical and reflective thinking and professional judgment development, in Degree structures. The demonstration of student's professional judgment can only be achieved through regular, calibrated embedded practice, preferably through a systemic, complementary range of types of reflective activity. However, the most immediate, personal and practical reflective activity for students is a personal reflexive predisposition towards objective and informed self-critique and self-assessment. Achieving this would be a worthy learning outcome of a University program and positively contribute to life-long learning.

The students in this study positively identify with self-assessment and desire to improve and develop their professional judgment skills. However, students not only self-reported a lack of practice, but their lower scores on confidence in their ability to accurately self-assess themselves against assessment criteria than task confidence, points to a lack of practice in this specific skill area. Additionally, their self-assessment estimates on their course grade pointed to endemic over-confidence, even in the final year of the undergraduate program. A wider, multi-cohort or program-based longitudinal study into practices that assist the development of self-assessment accuracy with an increased qualitative focus is proposed.

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Working in Partnership: An authentic professional learning program to promote sustainable curriculum change

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This paper describes a program that reframes professional development through a partnership model underpinned by an authentic professional learning approach and incorporating elements of design-based research and communities of practice. A secondary underpinning of the program is the development of key skills by the educational design and development group in both project management and evaluation of learning and teaching projects as well as effective online learning design.

The outcome sought from the partnership model is to promote sustainable curriculum change through the development of staff capabilities. Using curriculum design projects as the catalyst, the partnership program integrates faculty and centrally based approaches to design solutions to authentic teaching and learning problems. The collaborative nature of the program encourages scholarly dialogues between academic and professional support staff enabling increased output in scholarship of learning and teaching.

Keywords: professional learning, partnership program, authentic practice, curriculum design

Introduction

The need to support the continuing development of university teachers in terms of understanding teaching practice, student learning, different models of education and educational technology is well understood. Methods and practice to support this development are many and varied. Kennedy (2005) suggests a framework based on nine identified models of continuing professional development. Ferman (2002) describes what teaching staff find valuable, number one being collaboration with an educational designer, followed by attending workshops and short courses. Professional development activities are traditionally designed around the development of technical skills, teaching approaches, assessment and are primarily delivered through workshops, seminars and lecture programs. These activities are not always effective in transferring skills, especially given that the type and number of tasks that a University teacher is expected to engage in are becoming more complex (Ramsden, 2010). Lecturers also report having less time to undertake all the tasks necessary to be successful in their careers and so professional development activities may have low priority, as they are seen as disaggregated from their main job (Carter, 2005). Research has shown that the reasons for lack of participation in professional development opportunities, includes “a lack of time, a lack of expectations that they should, and the lack of infrastructure to support the training” (Johnson, Adams and Cummins, 2012, p.19). Furthermore this research found that the appropriate processes to accommodate this sort of professional development are rarely established and that *“a cultural shift will be required before we see widespread use of more innovative organisational technology”* (ibid.).

Overall, university models of support traditionally vacillate between faculty, school or departmentally based and those, which are centrally based (Hicks, 1999). In the former scenario, knowledge, skills and resources are maintained in silos often producing individual solutions to problems repeated across the institution. In the latter scenario, support is organised more systematically and efficiently but can suffer from disconnect with the academics' needs in relation to their specific concerns. Both models can suffer a lack of alignment with the institution's strategic priorities.

How do we develop meaningful activities that engage staff and that take account of faculty and centrally supported development and the strategic directions of the institution? This paper describes how one Australian university, through understanding what staff find valuable and using an integrated support model for professional learning, implemented a new program with the aim of enabling academics to develop new approaches for their teaching.

The model draws on the concept from situated learning environments that useable knowledge is best gained in learning environments which feature: authentic contexts; authentic activities; access to expert performances and modeling; multiple roles and perspectives; collaborative construction of knowledge which prompt reflection, articulation, coaching and scaffolding and; authentic assessment (Herrington and Herrington, 2008). The program has gone through a number of iterative development and review cycles, including stakeholder feedback, self-reflection by the program coordinators and team members, and evaluation from the academic leads. This process has helped shape the continuous improvement of the program.

This paper describes how on-going professional learning can be achieved when tied to collaborative development with central support staff and authentic learning activities not disaggregated from one's main work.

The Faculty Partnership Program

Overview

The Faculty Partnership Program enables academic staff to work in partnership with professional staff from within a central Educational Design and Development (EDD) group at one Metropolitan Australian university. The Program draws on the expertise of the EDD group in a way that optimises use of central resources, and aligns with faculty aims in learning and teaching. Submissions are invited twice a year (refer to FPP overview in Figure 1.) from teaching staff who will be convening a unit in the session following the expected delivery of project outcomes. All project submissions are ranked and approved for submission by the Faculty Associate Dean Learning and Teaching and Executive Dean and are submitted to the EDD group for possible resourcing. Based on an established set of principles underpinning this transformative, authentic learning program (Carter 2003, 2005, Cram & Kennedy 2009) submissions are assessed against criteria that projects need to: address in some way a strategic initiative or Faculty priority; develop or improve the learning design of activities and/or resources in at least one teaching unit; have outcomes with the potential for wider use in other units; and consider accessibility and universal design principles.

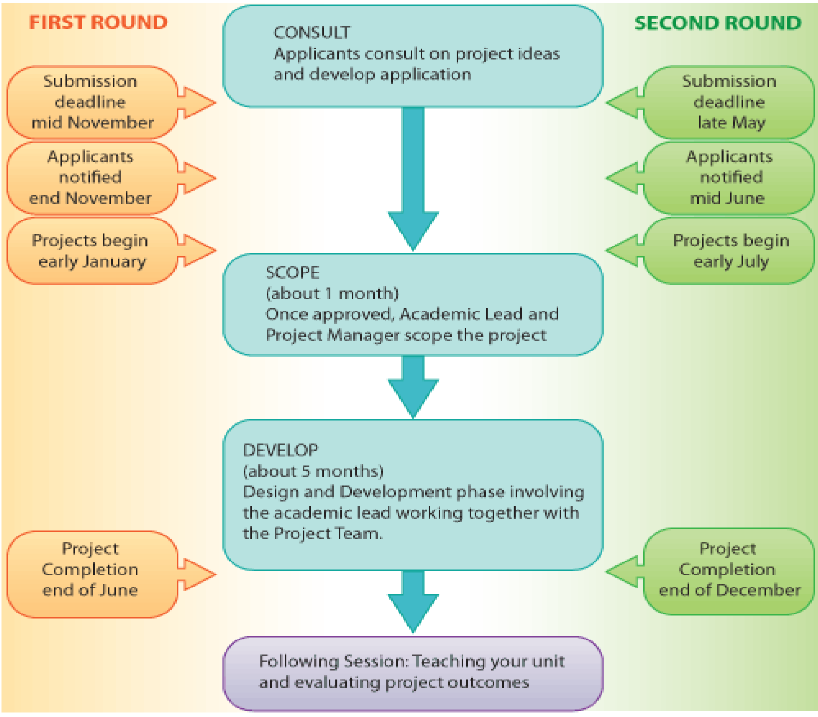

Figure 1: FPP overview and timeline

Once approved for resourcing, projects are assigned a team from within the EDD group, including a project manager. Team members meet regularly with the project's Academic Lead, and provide regular updates to the faculty and key stakeholders. Part of forming the project team entails brokering support from other central services which may include an academic developer, an accessibility services consultant, a media production professional and/or a liaison librarian. Each of these additional team members generally act in a consultative role within the project. While not using a formal project management methodology, nevertheless, projects are tightly scoped and closely monitored to achieve goals within a timeframe of six months of design and development. This short timeframe (as shown in Figure 1.) requires a concentrated investment of time from teaching staff which means that projects must have targeted impacts on learning and teaching.

Academic staff who participate in the Program benefit from receiving expert design support and pedagogical advice from EDD and other support staff, as well as developing their own confidence and skills. Many projects also include the creation of professional-standard, learning and teaching resources for use in a teaching unit. Project outcomes are designed to be sustainable, have the potential for broader application and contribute to the applicant's professional development. Projects that have external grant funding are not eligible, as this program offers in-kind support rather than financial support.

In summary, the aims of the Faculty Partnership Program are to:

- increase the impact of educational design services by strategic selection of educational design projects;
- increase staff confidence and skills in educational design and development;
- increase institutional use of learning and teaching systems and educational technologies;
- support the professional creation of teaching and learning activities and resources.

By bringing together faculty priorities and concerns with centrally based expertise, a true partnership can be developed to produce meaningful and sustainable outcomes. Examples of projects that have been completed under this program are shown in Appendix 1. These examples show how a learning and teaching problem such as a need to compress content or external students need for more feedback, drives a pedagogical solution.

Project Management

Each project within the FPP is managed through a cycle consisting of six phases, ensuring consistency between team processes (see Figure 2). The FPP project management phases define processes for inviting, collating, scoping and conducting projects. The phases allow for the redefinition of project scope in consultation with the academic lead and the implementation of both outcomes and documentation of the process for future development.

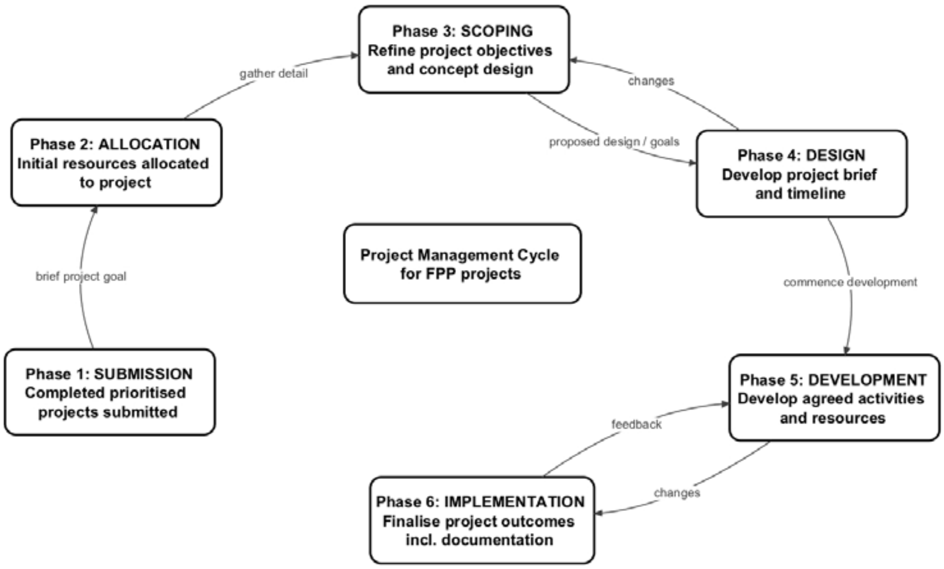

Figure 2: Project Management Phases for an FPP project

Submission, Allocation, Scoping (refer to Phases 1 – 3 in Figure 2.)
Academics are encouraged to meet with their EDD representative to discuss ideas and provide as much information as possible in the online application form. In addition to a brief project description, the applicant must provide the learning issue or problem area that the project will address, and explain how their project will benefit other staff, other units or courses. They must also indicate how many hours per week they can commit to the project and whether they have negotiated release or administrative support for their project. Finally they must indicate whether they are planning to be away during the life of the project and if so, how the project will be managed in their absence.

At a large group meeting of relevant EDD and other support staff, submitted projects are allocated a project team. The team composition is based on requirements articulated in their written submission and some pre-scoping by the Educational Developer allocated to that faculty. The first month of the project is taken up with scoping and development of a project brief. This work is then detailed in the first report that goes out to the stakeholders in each faculty including the Executive Dean and the Associate Dean, Learning and Teaching.

Designing, Developing, Implementing (refer to Phases 4 – 6 in Figure 2.)
Projects generally take a design-based approach whereby the relationship between pedagogy, learning artifacts and practice is explored (The Design Research Collective, 2003). Development of a design brief in collaboration with the academic lead is central to this phase ensuring their issues are met whilst at the same time producing innovative and fresh ideas for implementation. Using a design brief in this way encourages a collegial environment in which to capture the ideas, opinions and perspectives of all project team members. The projects are worked on for a total of six months. Various factors impact on the output of the project during this time, including availability of the content for the unit, and availability of the academic lead, as often there are competing priorities on their time such as teaching, marking and research. The mid project report is written after approximately 3 months and details the work carried out to date. At all times, the scoping document is used to guide progress and by the mid report project teams have a clear understanding of whether the initial stated aims are going to be realised, sometimes adjusting these to suit the contextual factors. The final report is written at the end of the project and contains examples of the completed project.

Project Evaluation

Each project in the FPP introduces evaluation in the scoping phase and details are included in each of the three progress reports to stakeholders. A Realistic Approach to evaluation (Datta, 1997; Pawson and Tilley, 1998) is used within the program as this enables the investigation of how projects are “effective in certain circumstances for certain groups of participants in certain contexts” (Owen, 2006, p.261). As can be seen in Figure 2, there is no specific evaluation phase completing the development cycle. The short duration of the projects is conducive to formative evaluation and some summative evaluation in terms of meeting objectives and reflecting on processes. Impact evaluation may be carried out once any changes or improvements in a particular unit are delivered to the students. As this tends to be some time after project completion, it needs to be considered either as a separate project in and of itself or as something carried out at a later date by the academic involved and guided and supported by a member of the EDD group. This aligns with the Action Learning Projects described in Kember (1998), whereby the educational developer acts as a critical friend "helping the participants to develop the necessary expertise rather than doing the evaluation for them" (ibid., p.58), thereby equipping teachers for continuous monitoring and improvement of their own teaching.

Stakeholder Reporting
In the first round of the FPP, project activities were reported to key stakeholders on a quarterly basis. This ensured any issues such as identification of resources, staff unavailability or any other potential risks could be addressed promptly. It also ensured transparency of processes and stakeholder engagement. In subsequent rounds, reporting has been simplified to three periods, which is better aligned with the project phases of the FPP and is more manageable given the short duration of projects. The first report now comes after the scoping phase, which is key to ensuring the project has buy-in from staff and quickly identifies any potential issues or risks to the project's completion, particularly around adequate resourcing. The second report comes mid-way through the project cycle, ensuring progress and then a final report upon project completion. Throughout the project, teams meet regularly and there is also a monthly meeting of all FPP project managers to share concerns and resolve issues collectively.

Ethics
To report on any evaluative outcomes in a scholarly fashion to the community, ethics approval is needed. This can be a long and drawn out process, often taking longer than the six month duration of a project, and therefore not practical to submit such applications for each individual project. In this instance, an application was made for ethics approval to cover all individual projects collectively in the program. This request was successful and now the program can further benefit the institution by enhancing scholarly output.

Evaluation of the Partnership Model

Introduction

Ultimately, the Partnership Program aims to enhance the student learning experience through building capacity in the design and development of learning environments. Evaluation of the program as a whole is necessary and utilises both formative and summative strategies. This can produce valuable empirical evidence to support the continuation and enhance the quality of the activities.

Approach

Educational designers and developers are increasingly using a design-based research approach to their work in this program, looking at what works and what doesn't and building on strengths during each cycle based on the skills and inclinations of the academic lead. As Dimitriadis and Goodyear (2013) state "Design methodologies need to be robust and general enough to cope with face-to-face, online and blended contexts, with synchronous and asynchronous interactions, as well as situations where teachers' time, skills or attention are limited …". Similarly, the program coordinator has adopted a developmental approach to review, reflect on and evaluate the program. This is also known as MERI - Monitoring, Evaluation, Review, Implementation (Wadsworth, 2011). The program is currently in its third round of operation and has gone through a number of small iterative developments to improve outcomes, based on feedback from the EDD group and other stakeholder groups.

Review of the first round of the FPP
In Semester 2, 2012 of the FPP, there were 13 Faculty proposals, 3 projects were delayed due to academic leads availability at initial scoping phase and 11 projects were scoped and implemented within six months. The remaining 2 were re-scoped and completed in January 2013.

The projects represented a broad range of learning and teaching support activities. While the majority of projects represented the immediate needs of academics, all related to University-wide strategic directions and all supported the broad objectives of the FPP. For example:

- all Faculties submitted educational design support proposals;
- media or online learning / assessment resources were created collaboratively to support eleven teaching

programs;
- seven projects focused on increasing staff confidence and skills in educational design and development; and
- all projects contributed to increased use of educational technologies.

Feedback from the Academic Leads
At the conclusion of FPP Round 1, a survey was sent to the academic lead of each FPP project to gather feedback on the Program by identifying successes and areas for improvement. There were 8 responses from a possible 13. Management of the projects called for a variety of skills and expertise from LTC staff. The following table provides an analysis of major tasks carried out for FPP Round 1 projects. (Note that projects may fall into more than one category):

Table 1: Summary of Faculty Partnership Program project tasks in Round 1

Design - assessment events		4
Design - interactive learning activities		4
Design - media objects		4
Design - new course/unit/curricular		3
	Total design tasks	15
Development – learning activities/elements		7
Development – audio-visual media		6
Development – new unit guide		3
Development – graphics		1
Development – template for online units		1
	Total development tasks	18
Review – course/unit/curricula		4
	Total review activity	4
Workshops – introduction to [LMS]		2
Workshops – online learning design		2
Workshops – other		1
	Total workshops run	5
Other activity		1
	Total other activity	1

The academic leads were invited to rate their confidence and skills in educational design and development after participating in an FPP project. 50% of the respondents agreed that they were 'quite' confident in this area and 25% 'somewhat' confident. 40% agreed they were 'quite' skilled and 40% felt 'somewhat' more skilled in this area. Academic Leads also responded about effectiveness of support in achieving project goals with 50% finding support 'extremely' helpful and 37% 'very' helpful. General comments reflected this appreciation of support and one participant cited the short length of projects as a limiting factor for successful outcomes.

Feedback from the Design and Development Group
Summative feedback was sought from the EDD group at the end of the first round of projects via a survey tool. Results were combined with formative feedback obtained through regular reflection and discussion during team meetings, and the following issues and solutions emerged:
- *Long lead-in time to start projects due to availability of academic leads and lack of clarity in the project proposal.* This was resolved by creating a proposal checklist for use by the EDD when consulting on applications. Also, by bringing forward the closing date for applications by a week more time could be spent on pre-scoping and clarification of project aims before academics leave for their breaks, thus supporting more efficient project start-up;
- *Internal team allocation meeting.* All members to be briefed fully beforehand such that decisions on team members can be made at that meeting;
- *Communications need to be wider and more timely.* Welcome letters were sent out to all project team members from within the LTC, including their supervisors. Also, the FPP website was redeveloped and more channels of communication were used to promote the program including both centrally and faculty based methods.
- *Following up on student outcomes (where applicable) after the project has finished.* This was discussed earlier under project evaluation.

Based on the feedback from both groups and critical reflections of the program coordinators, adjustments were considered to three areas of the program:

Project planning
A range of software solutions for project management were reviewed and discussed. We hoped to select one that was easy to use by EDD staff and also one that would not to add to the cognitive load of academics who were already learning to use new tools and processes within their online learning environments. Asking them to learn a new software system within the project was not deemed feasible. It was decided to make use of an in-house project management software for reporting and documentation as this was integrated with other systems including single sign on and authentication. Support and advice was given on how to manipulate the software to serve the needs of our program, however, the initial system trialed was too complicated for managing our particular type of projects specifically within the short timeframe. After consultation within the EDD group, a more flexible technology solution was chosen. It was decided to use the University Wiki for documentation and storage, as the ubiquitous use of such technology at the university enabled its seamless uptake by all members of the project teams.

Project management approach
A common approach to project management is by use of a timeline and milestones. Often such milestones can appear artificial, as many of the project managers felt in this program. Instead, a more realistic approach is taken to reporting, which includes information on the activity completed in that phase/period as well as achievements to date. Most importantly identified issues are presented with identified solutions to overcoming them. This iterative scoping approach allows the project teams to reassess priorities based on time available. Outcomes may well end up being scoped 'down' but overall this leads to an effective model whereby the academic can feel that they have made some relevant steps forward and they are themselves transparent to others.

Project length and timing
The current rounds of projects run January to June and July to December. Whilst this aligns well with the teaching semesters, there are also large periods of time whereby academics are unavailable such as the summer months (January and February), and conference season in July. The EDD group are also very busy with higher than average support duties around the start of each semester (February and July). This limits the project duration and in turn, the project outcomes. Much discussion was had within the EDD group and with the Stakeholders on when best to run the projects and whether actually 12-month projects would be better. There was no 'best' solution found and therefore reiteration was made of the importance of the scoping stage and revisiting through the design brief as the individual time restrictions play out in each project. A question about availability was also added to the application form to highlight the partnership arrangement in that both sides have to allocate sufficient time to the project.

Effectiveness of the Partnership Model

Analysing the effectiveness of the partnership model using the 4 key issues identified by Hicks (1999) when considering alternative models for the delivery of academic development.

- Access to development
- Resourcing and ownership
- Impact on student learning
- Generic versus discipline-based scholarship

Access to development
By situating development activities in the academic's context, the Faculty Partnership projects provide an authentic setting for learning to take place. There are no barriers, either physical or conceptual, to participation as can sometimes be found in centrally run development programs. The FPP offers an opportunity for central support teams of educational design and development experts to collaborate with local discipline experts. This opens the way forward for professional development and learning to take place that is discipline specific but also strategically driven to provide sustainable outcomes that can be of use across the institution not only in the local context. At this point the Associate Dean Learning and Teaching in each faculty has the ultimate say in prioritizing who can access this learning opportunity but everyone now has the ability to apply for inclusion in the program.

Resourcing and ownership
The first iteration of the program planned to open applications to all faculty based teaching staff with applications prioritised by the faculty Associate Deans (ADs) of Learning and Teaching (see Figure 2, phase 1).

Initially the ADs themselves nominated projects depending on their faculty's priority. Whilst this met their needs, it was not ideal as some of the Academic Leads were not familiar with the program's processes, having not applied themselves, particularly the short time scale for project completion. A consequence of this was difficulty obtaining the Academic Lead's buy-in to the project, resulting in a longer scoping phase, and shorter available time for design and development. In addition, two of the thirteen Academic Leads in the first round were unavailable during the initial scoping phase, which meant projects were extended into the seventh month. In subsequent rounds, this limited availability at initiation has been dealt with in two ways. A pre-scoping meeting was held where possible, such that the team could be correctly resourced and set up ready for project scoping. Then at project scoping, the deliverables were scaled back to take into account the shorter timeframe (rather than keeping to the six months and running over into the next round).

Feedback on this limiting factor regarding ownership was given to the faculties and in the second round of the program one of the four faculties did open up applications to their staff rather than pre-selecting projects. In the third round, three of the four faculties did this, although this wasn't without issue. Opening up a program of support with no financial backing may not be encouraging to staff. Time pressures for academics can often be alleviated by the possibility of 'buy-out' of teaching or marking time thus allowing time to work on a project. Without this financial support, academics may be reluctant to commit to such projects. This appeared to be the case as one faculty received no new applications once opened up to staff. The applicants that did come forward however were those who had been involved in the first round of projects and saw value in the expertise and resources provided by the program and felt ownership of the outcomes. In fact formative feedback has shown this to be the case in all of the projects initiated by an Academic (Lead) as compared to those initiated by the ADs. A strategy to publicise the benefits of the program along with some concrete examples of previous projects has now been developed to encourage this ownership in alignment with faculty priorities.

Impact on learning

Learning through the FPP is taking place across a number of dimensions (refer back to Table 1) and the results of this learning can have a beneficial effect on student learning through the design of more engaging and aligned activities (Dimitriadis and Goodyear, 2013). It is often difficult to measure impact of centralised development programs on student learning, as teaching success can be attributed to a range of interventions not to mention the teacher's and the students' individual characteristics (Hicks, 1999). In the Partnership model, preliminary feedback from the Academic Leads has demonstrated an improvement in their skills and confidence in educational design and development. The next step will be to incorporate student evaluation through questions aligned to the targeted project activities. This will enable impact on learning to be more effectively measured.

Scholarship

Hicks (ibid.) identifies that high quality and relevant research can be produced when there is partnership between an educational researcher and a faculty-based teacher. The Partnership model provides such an arrangement and in order to communicate findings to the wider education community, the program coordinators and EDD group members applied for human ethics approval from the university's ethics committee. This was made difficult by nature of the fact that approval was being sought for projects in the future, which are not yet able to be defined. All FPP projects, however, have a common goal in terms of curriculum improvement and a bank of questions were created that could be used in the evaluative inquiry process. There is no 'one type fits all' approach to evaluation (Mark, 2001; Torres & Preskill, 2001), however questions were grouped thematically and participants would come from one or more of three groups: the teaching staff; the students; and the project team members. This means that data could be collected ethically and used to write up research papers and conference presentations, furthering the success of the program in terms of its reach.

Conclusion

Whilst the program is still in its infancy, it is clear that progress is being made in terms of moving to a more sustainable model of professional learning and enhancement of curriculum design as demonstrated by the alignment with Hicks' (1999) criteria. The Faculty Partnership Program enables staff to engage in critical discourse about learning and teaching issues in an authentic context and through a community of practice. Such communities pave the way for professional learning and resonate with the words of Brown and Duguid (2000) that "practice is an effective teacher and the community of practice the ideal learning environment" (p.127). The human ethics approval for the program to collect evaluative data will allow further research and scholarship in collaborative curriculum design to be undertaken in future rounds.

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APPENDIX 1: Examples of Faculty Partnership Program projects

Problem	Solution	Outcome
Compress a 13 week course for delivery in a 6 week session	Redevelop the unit for fully online delivery in a way that was engaging for students, presented a clear learning structure and employed some principles of the flipped classroom.	Student feedback and level of engagement indicated a very positive response to content and structure. The unit is now being explored as a potential model for adapting other units for compressed curriculum delivery.
Deliver content in an engaging way in a new Doctor of Physiotherapy program	Develop high quality online audio-visual resources to support the student learning experience in the new program.	81 videos were recorded and a template for iLearn was built for use with all the videos, including key learning content. A video production guide was produced to support Physiotherapy staff to embed video from Vimeo into the learning management system (Moodle), themselves.
Provide a uniform approach to online content delivery across a program	Across four units, design a template, which is pedagogically sound but flexible enough to enable customisation for each unit's requirements.	A new Moodle template was developed with a common look and feel in Topic Zero, followed by scaffolding in each proceeding topic to structure resources and activities. Short welcome videos were developed for all conveners to introduce themselves to students. The units appeal in particular to students unable to attend traditional face-to- face lectures and tutorials.
External students were missing out on teacher interaction and feedback in internal class discussions and presentations	Investigate, trial and then implement a free virtual classroom tool. Combined with a Smartboard, this allows students to draw on the whiteboard from home and explain 'how to' do the task.	Using Scribblar, external students were able to interact with the teacher in an online synchronous exchange. file://localhost/See a video here/ http/::player.vimeo.com:video:11281701
To master the skill of writing computer code students must learn how to translate applications into somewhat abstract algorithmic problems.	The project explored the use of collaborative tools, such as wikis for testing algorithmic logic.	Content, resources and activities were added to an OpenLearning environment. Using the openlearning API, assignments are downloadable and able to be run through the stand-alone compiler/auto-marker that the computing department has developed.

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Integrating Learning Design, Interactivity, and Technology

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Student engagement has long been recognized as a serious challenge to learning and teaching in higher education. While increasing and innovative use of interactive digital technologies has been a hallmark of recent changes to higher education practice, the integration of traditional and innovative digital techniques in learning and teaching design and practice remains a crucial issue for university educators. There has been a tendency for new technologies to be added to existing curriculum design and learning and teaching practice in an *ad hoc*, isolated manner, rather than as part of an overarching learning design which incorporates both new technologies and traditional techniques and understanding of pedagogic principles and practice. Through the integration of the RASE (Resources/Activity/Support /Evaluation) pedagogic student-centred learning model, interactivity and applications of technology, this paper seeks to help teachers design more effective courses to enable students to acquire greater autonomy, and to cultivate dispositions to understand.

Keywords: learning design, interactivity, blended learning

Introduction

Student engagement – or the lack of it – has long been recognized as a serious challenge to learning and teaching in higher education. This has been particularly so in recent decades with the rapid growth and reach of higher education, nationally and globally, increasing the demands upon institutions to provide tertiary education to significantly larger and more diverse cohorts of students. One key solution to the challenges of engaging students in-class, online and, in recent decades, remotely through the use of interactive digital technologies, is the concept of interactivity (Gleason & Daws, 2012). A growing body of evidence has shown that interactivity is the key to human learning and intelligence, rather than abstract symbol manipulation, internal representations or information processing centred on the internal mental processes of the individual.

This paper is concerned with the issue of learning design and student engagement. It explores a practical, evidenced-based learning design model with applications of technology to improve student learning outcomes and satisfaction. The pedagogical student-centered learning model used is called RASE. The model has four components: Resources, Activity, Support and Evaluation (RASE) (Churchill, King, & Fox, in press).

The model builds upon theoretical concepts such as constructivist learning environments (Jonassen, 1999), problem solving (Jonassen, 2000), engaged learning (Dwyer, Ringstaff & Sandholtz, 1985-1998), problem-based learning (Savery & Duffy, 1995), rich environments for active learning (Grabinger, 1996), technology-based learning environments (Vosniadou, 1995), interactive learning environments (Harper & Hedberg, 1997; Oliver 1999), collaborative knowledge building (Bereiter & Scardamalia, 2003), Quest Atlantis (Barab, et al., 2005), situated learning (Brown, Collins, & Duguid, 1989), MicroLessons (Divaharan & Wong, 2003; Churchill, 2006), and WebQuest (Dodge, 1995).

The RASE model is based on what is considered important for ensuring quality in teaching and learning and can be used in almost every program and course. Central to the RASE is the notion that content or resources are not sufficient for full achievement of the learning outcomes. In addition to resources, teachers need to consider:

- Activity - for students to engage in using resources and working on tasks such as experiments and problem solving leading through experience towards achieving learning outcomes set
- Support - to ensure that students are provided help, and where possible with tools to independently or in collaboration with other students solve emerging difficulties. This support includes peer, course tutor and technology support
- Evaluation - to provide structured information to guide students' progress and to serve as a tool for understanding what else we need to do to ensure that learning outcomes are being achieved.

The figure below is a visual summary of the RASE pedagogical model.

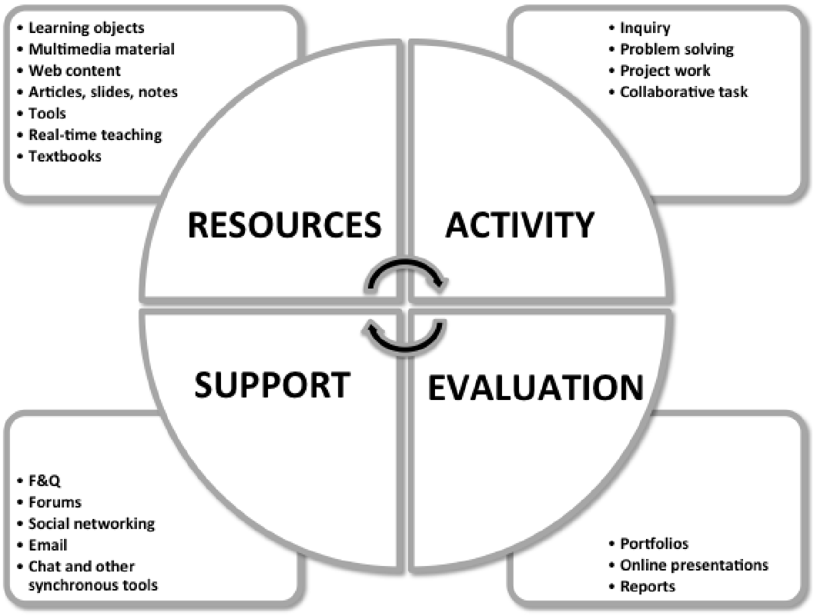

Figure 1: RASE pedagogical model

Resources

Resources include (a) content, e.g., lectures, textbooks, journal articles, digital media, (b) materials, e.g., chemicals for an experiment, paint and canvas, and (c) tools that students use when working on their activity, e.g., laboratory tools, brushes, calculators, rulers, statistical analysis software, word processing software. When integrating technology resources in teaching, it should be done in a way that leads students to learn *with*, rather than just learn *from* these resources.

Activity

An activity is a critical component for full achievement of the learning outcomes. An activity provides students with an experience where learning occurs in the context of emerging understanding, testing ideas, generalizing and applying knowledge. Resources, such as conceptual model learning objects, are elements that student use while completing their activity. The following are two key characteristics of an effective activity:

1. An activity must be 'student-centered'

- It focuses on what students will do to learn, rather than on what students will remember
- Resources are tools in students' hands
- Teachers are facilitators who participate in the process
- Students produce artifacts that demonstrate their learning progress
- Students learn about the process
- Students develop new literacies

2. An activity must be 'authentic'
   - It contains real-life scenarios and often ill-defined problems
   - It reassembles professional practice
   - It uses tools specific to professional practice
   - It results in artifacts that demonstrate professional competence, not only knowledge

The following are examples of what an activity may be:
1. A design project (e.g., design an experiment to test a hypothesis)
2. Case study (e.g., a case of how a scientist identified new physics regularity)
3. A problem solving learning task (e.g., minimizing friction in a design of a wakeboard)
4. Develop a documentary movie on a specific area of interest (e.g., GM food pros and cons)
5. A poster to promote a controversial scientific issue (e.g., Nuclear energy)
6. Planning a science day in your school
7. Developing software to control mechanical transfer of power
8. Role-play (e.g., defending science experiment with small animals)

Outcomes of an activity can be: a conceptual artifact (e.g., an idea or a concept presented in a written report), a hard artifact (e.g., a model of an electric circuit), a soft artifact (e.g., a computer-based creation). Artifacts produced by students should undergo reviews and revisions before final submission and might involve presentations in class or online. These artifacts must be evaluated in various ways so that students can receive timely feedback to reflect upon and take further actions towards more coherent achievement of learning outcomes. Feedback can be given by eg teachers, peers, invited experts from the community/professions.

Support

'Support' provides students with a scaffold while enabling them to develop learning skills and independence. Support can be broadly categorized into pedagogical, administrative and technical. This section focuses on the pedagogical support. For teachers, 'Support' reduces redundancy and workload. Support might anticipate student difficulties, such as understanding an activity, using a tool or working in groups. Teachers can track and record ongoing difficulties and issues that need to be addressed during learning, and share these with students. Three modes of support are possible: teacher-student, student-student, and student-artifact (additional resources). Support can take place in a classroom and in-online environments such as through forums, Wikis, Blogs and social networking spaces.

Often support can anticipate the needs of students. Depending on the course, proactive support structures such as FAQs can be planned and implemented in the light of anticipated needs. The objective of anticipatory support is to ensure students have access to a body or resources when they need support, rather than just being dependent of asking teachers for help. Here are some specific strategies:
- Build a body of resources and materials which form a FAQ Page
- Create a "How Do I?" or "Help Me" Forum
- Create a Glossary of course-related terms
- Use checklists and rubrics for activities
- Use other social networking platforms and synchronous tools such as chat and Skype

Overall, support should aim to lead students to become more independent learners. Teachers should give frequent, early, positive feedback that supports students' beliefs that they can do well. Students also need rules and parameters for their work. For example, before a student asks a teacher for help, they might first ask their classmates through one of the Forums and/or search the Internet for solutions to their problems.

Evaluation

Evaluation of student learning during the semester is an essential part of effective student-centered learning experiences. The evaluation needs to be formative in order to enable students to constantly improve their learning. An activity should require students to work on tasks, and develop and produce artifacts that evidence their learning. This evidence of student learning enables the teacher to monitor student progress and provide further formative guides to help improve students' learning achievement. Students need to record their progress in completing the tasks set, so they too can monitor their learning and the improvements they make. Rubrics can be provided to enable students to conduct self-evaluation. Evaluation can also be conducted by peers. Here are few points why evaluation is important to student learning:

1. Offers feedback on work and identifies where students are in their learning
2. Offers opportunities for students to improve their work
3. Enables students to become more effective and motivated learners
4. Helps students become more independent and self-directed learners

Putting it all together

The following set of recommendations might be useful to teachers in developing their courses and learning units based on RASE. Before beginning, teachers need to:

- Ensure that specific course learning outcomes are aligned with overall program learning outcomes
- Identify courses required to achieve learning outcomes
- Align assessment, courses and learning outcomes

These should be presented in an overall Course Outline document where details of the course, including learning outcomes, schedule and topics, and information about evaluation/assignments, etc. are clearly presented and aligned with each other. Once done, developing and presenting learning units can include:

- Describe a topic
- Present learning outcomes
- Describe what to expect and what to do if Support is required
- Explain prerequisites and how to build on previous learning
- Describe an Activity
- Explain the tasks within the activity
- Provide instructions about how to proceed initially
- Describe deliverables (artifacts to be produced), provide templates if any, provide examples of deliverables if any
- Present standards for Evaluation and provide rubrics
- Provide self-check and peer evaluation forms as required
- Explain support options

Resources to include, such as:

- Notes, articles and books
- Presentations, demonstrations and recorded/virtual and real lectures
- Interactive material - conceptual models and other forms of learning objects
- Videos
- Software tools
- Support tools

We also need to specify what is expected from evaluation and how it will be conducted, so that students have clear reference points for their work.

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College of Enterprise and Development
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Systems administration is a common career path for tertiary computing students, but it is difficult to take classes in the topic, especially at more advanced levels. Most of the classes that are available focus on specific tools and practices, often tied to particular vendors' systems. A set of topics around which to build a systems administration curriculum has not been clearly identified. At Otago Polytechnic we have developed a class that builds the specific knowledge and skills required to produce work-ready Systems Administrators.. The staff organised the class around a simulated workplace model rather than a more traditional lecture/lab model. This model emphasises having students perform tasks that are, as nearly as possible, identical to the tasks that they will eventually perform in a workplace. While the first instance of the class was generally successful, some issues, especially with assessment, were noted.

Keywords: Systems administration, Operations, Education

Rationale for the Class

Systems administration is the practice of installing, configuring, maintaining, troubleshooting, and generally managing computer and network systems (Nemeth, Snyder, Seebas, & Hein, 2001). This role emerged, at least in its present form, after about 1970. Since that time the role has evolved considerably and it continues to evolve at a rapid pace. (Most notably, the role was originally referred to as *System Administration*, indicating that a single server was involved. Now that even small organisations typically operate multiple servers, we typically refer to it as *Systems Administration*.) We might expect a job that has existed for over 40 years to be very well defined. However, this is not the case for systems administration. Even the League of Professional Systems Administrators says, ``... we're still not a profession," in part because the field has not identified a body of common wisdom nor the people to uphold and teach it. (LOPSA)

Because the systems administrator's role is hard to define, it is also hard to obtain training to become a systems administrator. It is possible to receive training in certain systems administration tasks, for example through training and certification programs offered by vendors like Cisco (Cisco Systems), Microsoft (Microsoft) and Red Hat (Red Hat), and these programs also inform the curricula of tertiary education programs. But these courses focus on basic skills without providing an opportunity for students to synthesise those skills into a body of practice. Whereas a student learning software engineering starts with elementary programming classes and progresses to increasingly advanced topics, a student learning systems administration is often limited to taking isolated and sometimes only elementary classes. The problem has a chicken-and-egg quality to it: it is hard to design a class in systems administration because the nature of the field isn't clearly defined, but it is also hard to describe a profession for which there is little training available.

Otago Polytechnic decided to address this problem by offering an advanced class in Systems Administration beginning in 2013. The staff were convinced that it would be possible to identify a collection of high level topics and tasks that would be relevant to aspiring systems administrators and that were not covered in other classes in the degree. This view was supported by discussions and emails with working systems administrators. In practice the challenge was not finding enough material, but rather narrowing the list of topics into one that could be reasonably covered in a single semester. The topics chosen include time and workflow management, documentation methods, centralised monitoring and configuration management, and communication skills.

Approach

The class was not organised around a collection of lectures and labs. Instead, it was designed to provide a set of connected experiences that allowed students to build and apply the same skills they would eventually use in their workplaces. This was accomplished using a simulated workplace class model that replicated as realistically as possible the actual experience of being a systems administrator. The model was an implementation of Work Integrated Learning, an approach that has been shown to build professional capabilities in students (Billett, 2011). Students worked in small teams to build, document, and operate a multi-tier web application. They used industry standard tools to monitor, manage, and back up their systems. They were assessed on the basis of how well their systems worked and on the quality and professionalism of their work practices. The goal was that students learn how to be systems administrators rather than learn some material that systems administrators happen to know.

To ensure that the class accurately modeled industry practices, working systems administrators were consulted for recommendations on the tasks and tools used. Many suggested multi-tier web applications as examples of realistic tasks with the desired level of complexity. One commented, ``A multi-node load balanced web frontend with some middleware and then a clustered DB setup. I think having seen data flow through a system and being able to hold all that in your head is often missing. Troubleshooting lots of moving parts will teach them how to exclude what isn't the problem." (Powell, 2012)

The course was built upon three conceptual pillars:

Real Tasks

Students should have the opportunity to work on systems that are identical to those that are used in the industry. This can be accomplished by directing the students to install, configure, and operate a real service that is deployed in the field. Just as a child is taught to ride a bicycle by giving her a bike and helping her attempt to ride it, a student may be taught to carry out professional tasks by giving her actual tasks and helping her attempt to perform them.

Real Tools

As the students are working on real tasks, they should perform those tasks using the same tools they will use after graduation. Most of the required tools are software that can be easily supplied to students. But the tools may also include online services or network infrastructure, and course preparation may include setting up those resources.

Real Assessment

When students are working on real tasks it makes sense to assess their work according to real, professional standards. Students can be evaluated on whether their services work reliably, whether they perform well, whether their systems are well documented, whether the students successfully solve problems that arise, and whether they can clearly and accurately describe their work.

Tasks

The class was organised around a large primary task that would occupy the entire semester: installing, configuring, deploying and operating a multi-tier web application. A web application deployment was chosen because it required setting up multiple systems, because it provided a good platform to address issues of performance, scaling, and security, and because it was fairly easy to simulate the actions of large numbers of users using commonly available web testing tools. But most importantly, the task was chosen because it is exactly the sort of task performed by working systems administrators. One large task such as this helped create a more realistic experience than a set of disconnected exercises would. This main task naturally divided into discrete subtasks that each illustrated important lessons. Students worked in two person teams so that they would learn to work collaboratively, including coordinating schedules to provide coverage and using documentation and related tools for intra-team communication.

The semester's tasks were divided into four phases:

Introduction

At the beginning of the semester students were introduced to tools for tracking and documenting their work. They were shown how to use a *ticketing system* to enter tasks to be performed, identify and accept tasks that needed to be done, enter information about the task while working on it, and mark tasks as having been completed.

Next, the students looked at methods for creating and maintaining documentation. They learned that wikis are a widely used tool for collaborative systems documentation (Limoncelli, Hogan, & Chalup, 2007) and were encouraged to set up a wiki for their documents. For each task that followed during the semester, they were expected to add to or update appropriate documentation. In particular, they were required to maintain logs that tracked the administrative state of each server or homogenous group of servers and to maintain an operations document (Limoncelli & Grace) for each discrete service.

Basic Systems Administration

Students began working with actual systems by setting up two running servers. They set up Microsoft Active Directory Directory Services for user management and then configured a Debian GNU/Linux server to run a MySQL Database Management System (DBMS). The Active Directory server would be used later in the semester to authenticate users of the web application, and the MySQL server would provide the database services for it. At this point the learning goals were to become familiar with basic tools, to work methodically, and to document work as it was performed so that their documents reflected as nearly as possible the running state of their systems. At the end of this phase students had their first formal assessment, described below.

Advanced Systems Administration

Later in the semester students deployed their web application servers which, together with the Active Directory and database servers prepared earlier allowed them to provide the full application. Students also set up servers to provide backup and recovery services, system monitoring, and configuration management. Each of these tools is described in the *Tools* section below.

Ongoing Operations

Once the full infrastructure was in place, students had to operate and maintain their servers. They were presented with a variety of tasks and problem scenarios, some of which are described in the next section.

Dynamic Tasks

Since practical systems administration involves responding to unexpected events, often occurring at inopportune times, these situations were modelled in the class by introducing *dynamic tasks*. The lecturer had a collection of tasks prepared to be introduced into the class at various times as deemed appropriate to maintain the simulated workplace theme. It was important that students not know the specific nature of the tasks in advance, although they were told to be prepared and appropriate working practices were identified and highlighted to allow them to do so. Examples of dynamic tasks include:

Sick Day: On a chosen day, but without prior notice, a student team may be directed to hand over control of their systems to another team. The other team is then directed to execute a task using only the documentation and resources provided by the original team.

Load Spikes: One reason for using a web application is that it is easy to generate load on the system using tools like Apache Bench. These tools can be used to generate an unexpected load on the system, forcing students to deploy additional servers on short notice. This tests their use of automated monitoring and configuration management.

Security Breach: The instructor places rootkits (Bradley) on students' servers, sets up rogue FTP servers, and uses them to distribute files. All of this is done without informing the students. They then have to detect the intrusion and take action to mitigate the damage.

To facilitate preparation for these dynamic tasks, the lecturer prepared a collection of scripts that performed required steps on each teams' servers. This sort of automation allowed the lecturer to stage realistic working scenarios efficiently and may be the subject of a future paper.

Tools

An important premise of the course was that students should work with the same tools that they would expect to use in industry. Since these tools are generally either open source or are licensed under favourable terms for teaching use, this proved easy to do.

One critical tool for successful delivery of the course was virtualisation (Hickson, 2008) . The only practical way to give a large number of students full control of several servers was by virtualising them. Since virtualisation is itself a real tool used in industry, this requirement fit naturally into the scheme for the course. Otago Polytechnic had VMWare's vCloud Director available, so this was used. A cloud service provider such as Amazon Web Services would also be suitable.

A ticketing system allows users to enter request for tasks to be completed, tracks the tasks as work on the progresses, and manages communication between involved parties. Ticketing systems are an important time management tool for systems administrators (Lear, 2011). Request Tracker (RT) (Best Practical) was used for ticketing. Most interaction with the system is handled through email, so it can be inserted naturally into a typical task management workflow.

Students were required to use a wiki or other shared online document system for documentation and a source code control system for managing scripts and configuration files, but were left free to choose which to use. The intent was to give the students an opportunity to evaluate options and select ones that suited their requirements, but in practice this led to difficulty in assessing student work. During future instances of the class students will be directed to use specific wiki and code management tools.

A backup management system performs scheduled backups, manages storage media, and executes requested data restore operations. Bacula (Sibbald) was used for backup management in the class.

Puppet (Puppet Labs) was used for configuration management. Students defined various server roles and identified the software and configuration required for servers to carry out those roles. The Puppet system then installs the specified software and performs the required configuration on servers. It was chosen primarily because of its cross-platform compatibility, but also because of its wide use in industry.

Nagios (Nagios Enterprises) is a well-known system monitoring package that analyses system uptime and resource usage and that can alert systems administrators to problems and potential issues, and that produces reports on system performance. Nagios was used so that students could be presented with various problem scenarios, identify the problems, and respond to them.

For the web application the primary requirements were that it should be reasonably complex, work with an external DBMS, be able to authenticate users against Active Directory (but not itself be a Microsoft product), and be well documented. Atlassian Confluence (Atlassian) met these requirements and was used, although many others would have worked as well. A MySQL database server and an Active Directory authentication server were used to support Confluence.

Assessment

Limoncelli and Grace list 32 yes/no questions that measure an operations team's compliance with industry best practices (Limoncelli & Grace). Students were introduced to the list in the first lecture and the questions were discussed. These questions set the standards against which student work was assessed. While not every question was applicable to the systems used in the course, most were. For the ones that were not, identifying them and explaining why they did not apply was still informative. Examples of relevant questions include:

- Is your team's code kept in a source code control system?
- Does each service have appropriate monitoring?
- Are your backups automated?

Throughout the class, topics discussed and tasks performed were linked to the appropriate questions on Limoncelli and Grace's list.

Students performed three assessed activities during the semester.

Individual Server Configuration: During the first part of the semester students configured two servers, one running Windows and one running Linux, and prepared supporting documentation and resources. They then submitted their servers and documents for assessment. At this point the complexity of the systems administration tasks that students had performed was quite low. What was assessed was the use of sound workflow: that tasks were tracked in the ticketing system, carried out on the servers, and accurately documented. While students were able to configure the servers, several of them appeared to have difficulty incorporating the ticketing system into their workflows and some tickets were not properly closed. In future instances of the class it may be necessary to provide more guidance on the topic.

Managed Server Configuration: After the first assessment students moved on to build a complete managed and monitored systems infrastructure. They were then assessed over a two week period during which they had to operate their systems while also responding to a number of challenges like the dynamic tasks described above. Students were evaluated on systems uptime, observed performance, team task management, and maintenance of correct documentation.

All student teams, with the exception of one team that did not fully participate in the activity, maintained service uptime aside from periods when the lecturer deliberately interfered with services as part of the assessment. Two teams achieved 100% uptime because their server monitoring was thorough enough to detect and halt this interference before services were affected.

"Final Exam": A traditional final examination would have been inappropriate to this class since an exam would not be part of a typical workplace. Instead, the simulated work experience theme was taken to its logical conclusion. The students were "made redundant" at the end of the semester and had to apply for new jobs. To do this they prepared CVs and cover letters describing their experiences. Then as part of the application process they were directed to take a short written test followed by an interview (with the lecturer) in which they were asked to describe in detail the work they performed, the methods, and the tools that they used. Besides assessing the students' understanding, this task also provided an opportunity to learn useful job searching skills.

As part of their interviews students were asked about systems administration software they had used. Several students commented positively about their experience using Nagios and observed that it proved very useful in operating their systems.

Conclusions and Future Work

To gain some insight into students' perceptions of the course, 24 of the 34 students enrolled in the class were surveyed to determine their views. They were asked to rate the technical level of the class on a 5 point Likert scale.. The mean response for this question was 2.96 ($\sigma = 0.86$). Students were also asked their opinions about the technical level of the paper using a similar five point scale. The mean response was 2.88 ($\sigma = 0.68$). Thus, students generally found the level and pace of the class to be appropriate.

One challenging area encountered in delivering the class was designing, communicating, and evaluating appropriate assessments that fit with the simulated workplace model. For example, a student's success in operating a service may be evaluated by measuring observed uptime and comparing and it with targeted values. However, it is difficult to determine a reasonable value for uptime targets until more students have been observed performing the activity. Another value that can be measured is time to resolve system problems (that are introduced as dynamic tasks), but again it is unclear how long students at this level should take to resolve the problems. Some ideas of target values for these assessments may be found by looking at service level agreements (SLAs) used in industry. These agreements indicate that systems should provide uptime percentages greater than 99% (Baset, 2012). However, it is not obvious how to apply these industry measures to student work. While the assessments used in the first instance of the class worked reasonably well, there is room for additional development of assessment activities and these may be the subjects of future work.

Another problem was presenting an effective simulated workplace model during the first weeks of the class. Students built up their server infrastructures from scratch. Because of this, the tasks performed by students in the first part of the semester may have been too easy, and the volume of tasks may have been too low. This is also not representative of a typical workplace in which systems administrators have to maintain existing infrastructure while simultaneously designing and deploying new systems. In future instances of the class students will begin by taking responsibility for a preexisting virtual infrastructure to which they will add systems and services over the course of the semester.

In general the class seemed to succeed in providing relevant and realistic learning experiences for its students. One student who was already working in a systems administration role commented, ``It's teaching me practical skills that I am already implementing in my workplace."

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Do 21st Century Students Dream of Electric Sheep? A mobile social media framework for creative pedagogies

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Students sometimes appear to be ‘asleep’ and are often updating their Facebook status during seminars and lectures. We argue this is the equivalent of counting electric sheep. Student brainwave activity measured during traditional lectures has been shown to be similar to that while watching television and significantly lower than that exhibited during any form of activity including sleep (Mazur, 2012). Mazur found that introducing interactive activities in lectures significantly increases brain activity. In this paper we explore the potential for mlearning to enhance student interactivity and collaboration both in the classroom and in authentic situated learning contexts. We partnered with Vodafone New Zealand and Auckland Transport to provide our students with an iPad Mini, and 4G connectivity, to enable student-generated research projects. The students’ brief was to design an enhanced experience of commuting via public transport in Auckland City. Thus the research investigates how mobile devices can be used enable interactive learning environments.

Keywords: Pedagogy, Heutagogy, Mobile Social Media.

Introduction

Mazur (2012) argues that the brainwave activity (or lack of) during traditional learning environments would indicate that students are stimulated less than while sleeping by passive learning environments. Infamously Philip K Dick (1968) wrote a novel titled “Do androids dream of electric sheep?” to explore the notion of self-awareness of artificial intelligence in robots. We suggest that traditional teacher-centric content delivery pedagogies are a passive experience for 21 century students that drive them to seek more stimulating engagement via Facebook, email or other socially connected activities during class time, effectively driving our students to dream of electric sheep (via connected, social networks) during teacher-delivered monologues. Mazur’s research demonstrates that introducing interaction, collaboration and student-generated content into learning experiences significantly increases brainwave activity and learning outcomes. In today’s world where the most ubiquitous technology is mobile (ITU, 2011) and mobile internet connectivity exceeds fixed connections, education must include a critical engagement with new technologies including mobile social media. As Yagou (2007, np) argues: “Having started as craft-based training with rather narrow vocational aims, design education is developing into an interdisciplinary academic field emphasizing research and preparing designers for a knowledge economy”.

The recently developed Product Design programme at Auckland University of Technology is underpinned by physical studio experience for students that supports and facilitates a Design Thinking approach (Bauer & Eagen, 2008). While great physical studio spaces provide an excellent environment to support the learning and teaching of key aspects of Design Thinking including group collaboration, brainstorming, drawing/ideation and

3D prototyping, these studios have a danger of 'insulating' students from real-world design contexts. The situation is similar to Architectural education, based on what once was considered a radical studio model, "Architectural pedagogy has become stale… curricular structures have hardly changed in recent decades, despite the major transformations that have taken place with the growth of globalisation, new technologies, and information culture" (Colomina et al., 2012). In contrast, Design Thinking methodologies also require human-centred observation, interviews and the testing of ideas and concepts in real-world situations. Design Thinking also requires students to collaborate, share and to reflect about their works 'on-the-fly', while mobile, and in less formal learning situations.

Drawing upon disciplines outside of design, including media studies, communication and education, the integration of mobile social media, mobile phones and tablets, blogs, twitter and other social media tools has the potential to enhance the Design Thinking process, acting as a catalyst for new pedagogies (Kukulska-Hulme, 2010). It also has the potential to complement, augment and enhance great physical learning environments by providing the tools and mechanisms that encourage students to take their learning outside into the 'real world', and to work more collaboratively in new and effective ways. As Balsamo (2011) argues, higher education needs an epistemological reboot. We argue that in essence such a reboot will provide a bridge between the formal and informal learning contexts for Design Thinking utilizing mobile social media.

This paper presents the background, the implementation, and the impact of a project, which aims to use mobile social media to augment and enhance a Design programme underpinned by Design Thinking. The goal of the project is to enhance student-learning experiences, positively impact their Design Thinking expertise development, and to explore the future of Design Thinking education enhanced by mobile social media. In addition it provides an opportunity for a small university department to engage with implementing and sustaining pedagogical change enabled by technology through the establishment of communities of practice (Cochrane, 2010). Building upon our work of establishing a framework for mobile social media integration in higher education (Cochrane and Bateman, 2013) we explored how to harness the affordances of mobile social media to stimulate student-generated learning in and beyond the classroom (Cochrane and Withell, in press). We use the concept of the pedagogy-andragogy-heutagogy (PAH) continuum (Luckin et al., 2010) as a measure of pedagogical change enabled by the introduction of mobile social media within the curriculum. Luckin et al., (2010) argue that heutagogy, or student-directed learning (Blaschke, 2012), need not be the sole domain of post-graduate education, rather pedagogical strategies can be seen as a continuum encompassing teacher-directed pedagogy, student-centred andragogy, and student-directed heutagogy. While this paper focuses upon one specific mlearning project during 2013, the research was part of a wider community of practice involving all of the lecturers in the Product Design department begun in 2012, with the aim of enhancing the curriculum across all three years of the bachelors degree, involving a four fold approach including: integrating the use of mobile social media into the curriculum, establishing student eportfolios as a core aspect of the design curriculum, critically underpinned by a Design Thinking Toolkit (DTT), and new 'smart' assessment strategies.

The outcomes of the mobile social media project during 2012 resulted in a radical conceptual shift within the thinking of the lecturers, where "mobile social media was reassigned from the category of a purely social tool for informal use into a powerful tool for student-generated content and collaboration within student-generated learning contexts" (Withell et al., 2012). This conceptual shift then led to the reimagining of core tools for supporting social constructivist pedagogy throughout the programme, leading to the implementation of a mobile social media framework across the entire Bachelor of Product Design programme. Implementing this framework involved three key aspects, including: creating a new culture around building learning communities, integrating the pedagogical use of mobile social media into the curriculum, and providing the technology infrastructure required to support the use of mobile social media. Our review of the mlearning literature revealed that there are few mlearning projects that design for these three key aspects (Cochrane, 2013). A notable exception was the MoleNET project (Attewell et al., 2010), which focused upon developing a rigorous teacher professional development strategy, embedding the use of technology in the curriculum, and making informed decisions about the choice of technologies. From our previous experience, failing to provide technological infrastructure to support pedagogical innovation and curriculum redesign leads to project failure (Cochrane, 2012b). The integration of the social media framework into the Product Design curriculum involved three stages, with each stage aligned with each year of the Bachelor of Product Design programme, as shown in Table 1.

Table 1: Staging and scaffolding the PAH continuum

Stage	Learning context	Mobile social media project	Course timeframe	Infrastructure	PAH alignment
Level 1	Social collaboration with peers and lecturer Student generated content	Establishment of student-generated e-portfolios using student-owned mobile devices, Wordpress blogs, and critically founded on the mobilized Design Thinking Toolbox.	First year of Product Design course	WiFi Lecturer iPads R2D2 presentation systems	Pedagogy (lecturer directed)
Level 2	Social collaboration with peers and 'authentic environments' Context aware	Student project collaboration using Dropbox, Google Drive, and student-owned mobile devices.	Second year of Product Design course	WiFi Lecturer iPads R2D2 presentation systems	From pedagogy to andragogy (students become the content creators)
Level 3	Context independent, bridging formal and informal learning Student generated contexts	Student-negotiated team projects exploring the unique affordances of mobile devices in partnership with Vodafone New Zealand and Auckland Transport	Third year of Product Design course	Student iPads with 4G MOAs	From andragogy to heutagogy (students become independent learners)

Methodology

The context of this research project was the third year of a Bachelor of Product Design. Participants included 24 students, two lecturers, and two researchers. As we are interested in pedagogical change and better graduate outcomes, a participatory action research methodology was used (Swantz, 2008). A survey of the 2012 third year Product Design students indicated that less than 40% of the students owned smartphones and none owned tablet devices. Therefore to implement this project we required appropriate mobile devices for the participants. The authors secured a contestable grant from Vodafone New Zealand to supply all third year Product Design students with an iPad mini and 2GB per month mobile broadband data to utilize during a project to investigate and design an enhanced commuting experience for public transportation on Auckland buses. An acceptable use policy was created and signed by all participating students that outlined the project expectations and use of the iPad Mini. Students also signed ethics consent forms consenting to anonymous use of data associated with the project for research publication. Students were expected to use their mobile device on a number of social media platforms including: Wordpress, Google Plus, YouTube and Twitter. The project was introduced and supported by several mobile social media tutorials curated via Evernote (**http://tinyurl.com/b5d97vr**).

Enabling mobile collaboration was a key goal of the project, thus we explored designing infrastructure options for facilitating this. Two approaches were taken, exploring wireless mobile presentation systems for video projectors in large group settings, and wireless small group collaborative workstations using large screen mounted displays. Wireless mirroring of mobile device screens is a relatively new affordance that was introduced in the 2011 Airplay update of the AppleTV software and built in to the iPhone 4S and iPad2. This was quickly followed by similar wireless screen mirroring protocols for Windows (WiDi) and Android (Chromecast) based mobile devices. Based upon the work on Mobile Collaborative Workstations (COWs) by Mitchel et al., (2009), we developed MObile Airplay screens (MOAs) to enable students to share and interact in groups directly from their mobile devices. Using wireless screen-mirroring technologies such as Airplay (Apple Inc.) and Allshare (Samsung Electronics) students can present the screen of their mobile device onto a large-screen mobile display turning their mobile device into a group presentation and collaboration tool. The MOA acronym plays on the name of the large flightless bird once native to New Zealand, similar to the Emu, but now extinct. These MOAs can be wheeled into different spaces for students to breakout into teamwork during or in-between classes. Thus we expand the collaboration and connectivity affordances of mobile social media from a personal workspace into a group collaboration space. This allows a refocus in the classroom context from teacher-directed pedagogy towards student-directed heutagogy. Students were assessed on their application of the Design Thinking processes throughout the project. Project criteria included: planning and management, analysis, research, synthesis, communication, and appropriate use of mobile social media.

Research questions

There are two research questions informing this project:

1. How can mobile social media be used as a catalyst to enable student-directed collaboration in and beyond the classroom?
2. How can we design presentation systems that turn a personal mobile device into a collaborative tool?

Data collection methods included: the collation of participating lecturers and students web 2.0 eportfolios via RSS feeds within Google Reader, student pre-project surveys, and informal focus group discussions. Student feedback throughout the project was used to inform tweaks to the research project implementation.

Data and analysis

All participants had established Wordpress blogs during 2012. This was extended in 2013 by the use of the Wordpress App for blogging from their iPads anywhere, anytime. Students used their Wordpress blogs as the hub of their eportfolios for the project, embedding YouTube videos and a variety of social media into their blogs. These were aggregated via RSS feeds by Google Reader, and curated by the students via the Flipboard App on their iPads. Analysis tools included the use of Surveymonkey for student feedback, discourse analysis of participant blog posts using collated word clouds, and transcription of participant reflective videos that had been uploaded to YouTube and embedded in their blogs. This enabled identification of emerging themes, and this was triangulated against the observation and identification of critical incidents from focus group discussions with selected students. Another rich source was the use of Google Docs for collaborative comparison of previous course assessments with those developed as outcomes of the project.

Results

The initial rollout of iPad minis for the students was met with unsurprising enthusiasm, with the most immediate impact being most noticeable in a significant higher level of engagement with blogging as student design journals.

> Today was a big day for AUT Product Design 3rd Year Students. Surprisingly to us, Apple [*Vodafone*] has kindly given us iPad minis to use for the year to make blogging and research for our designing easier and quicker. Having the apps on display for all our needs makes the blogging experience a lot more fun! (Student blog post, March 2013)

A survey of the participating students at the end of the first semester of the project asked the students to indicate what activities they had used the iPad for (Figure 1), and to rate the most useful affordances of the iPad (Figure 2). Figure 1 indicates that students used the iPad mini to document their design processes and record the design activity associated with their projects. Less used were the communication affordances of the iPad, with Twitter being used by only 26% of the students for collaborating on their projects, and none utilizing Google Plus. 80% of students did however make use of Facebook on their iPad. Facetime (video calling) and audio recording were used by a significant number of students, mostly for free video calling between team members, and recording of interviews with industry experts and public transport patrons used to gather feedback on the Auckland Bus transportation system. Figure 2 indicates that the experience was a positive enhancement across a range of activities for students, with no direct negatives identified. Most valued by the students was the mobility and ubiquitous connectivity of the iPad, particularly allowing them to reflect and critique in situ experiences that previously required separate documentation and subsequent recording and evaluation. They were able to record and critique the implementation of their bus trip enhancement designs while on location and coordinate intricate real-time experiments.

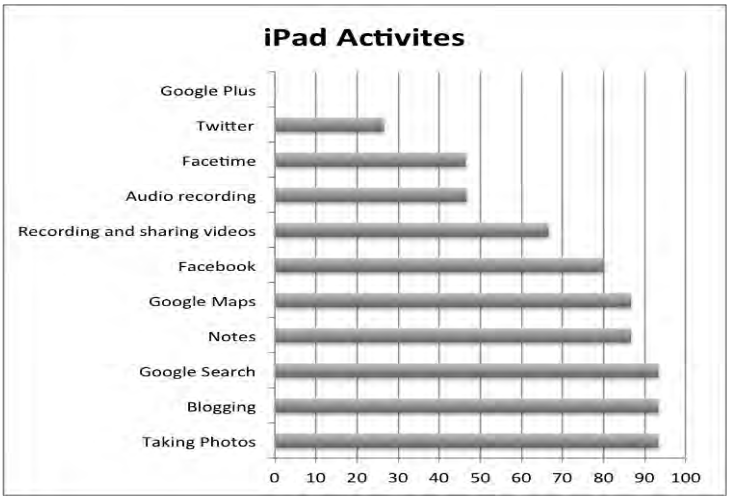

Figure 1: Types of iPad activities

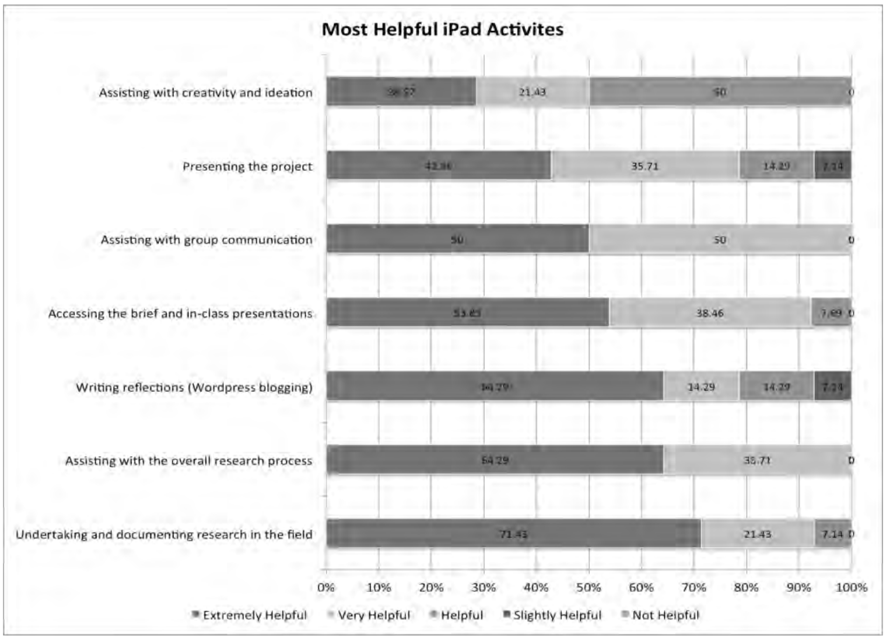

Figure 2: Most helpful iPad activities

A visual summary of student feedback is shown in Figure 3, represented by a word cloud of collated student reflections on their iPad experience posted to their course blogs. The creative, serendipitous and empowering nature of mobile blogging featured strongly in student feedback, as well as the temptation to procrastinate. As Figures 1 to 3 indicate one of the highest uses the iPad was for blogging including blogging in situ while reflecting on their experiences. On average student blog posts increased 500% after the introduction of the iPad in 2013 in comparison to the average number of blog posts per student during 2012. Students also began embedding YouTube video reflections on their blogs for the first time after the introduction of the iPad.

Figure 3: Wordle of collated student feedback

An example of the development and progression in the way students integrated the use of the iPad into their work flows, collaboration and off campus research is captured nicely in a series of video reflections posted to a student's blog. These video reflections are transcribed below.

> We've been using the iPad for. Multitude of different reasons, including blogging, and its a really good tool for reflecting immediately upon things that we have done in lectures, and doing stuff on the go - we can take it where ever we want, use our 3G to do work on the Ferry on the way home. And it's so good that it's so light, I can just pop it in my bag and cycle to Uni without having to lug around a massive laptop anymore - it's awesome. (Student video post, March 2013)
>
> We used our iPads for our presentations in a really cool way - we linked our iPads to our presentations via an Appletv and then we could see where we were up to without having to look at the screen behind us. It looked really funny because everyone had their iPads out during their presentations so we could take notes and video each other, which could be a really useful tool for viewing and analysing our presentation skills. I've also been using it for doing stuff on the spot - I'll be away somewhere and I can quickly note ideas and capture raw data. Some of the negatives: it's a bit of an addictive technology, that once you've got it you feel like you need it all the time, every few seconds you can check it - you get notifications, and you need to sort out what is important - you have to get a good balance going. Other than that I'm finding it a really good tool, for blogging especially, and reading and annotating notes. So far I'm very pleased with the iPad. (Student video post, April 2013)
>
> So here I am, on location in Ngaruawahia, fitting in some thinking, reflecting and a bit of work during a long weekend. The iPad is pretty supreme for this - it's pretty much the one thing that the iPad is the most useful for - taking it on location with you and being able to do work on the go. One of the most useful Apps I've found so far is this new YouTube App - you can take video and upload it straight away without the hassle of trying to convert it from one format to another. Another fave App of mine at the moment is the Mail App and the calendar - being able to organise your life on the go including your Uni life and social life and how everything can fit together, especially when things get chaotic at the end of semester. The iPad has been really good for my learning so far - you can do everything quickly and efficiently. (Student video post, May 2013)

Students tended to evidence a progression from using the iPad as a convenient replacement for activities they would previously have achieved on a laptop or desktop computer, to exploring activities that were previously difficult or impossible to achieve with a laptop or other computing technology. There were many location photos, recording paper brainstorms, and interview notes posted to student Blogs from the iPad. While there was plenty of evidence of the use of the iPad for enhancing productivity and for recording ideas and activities, there were also examples of students using the iPad and its 4G connectivity to achieve creative collaborative activities that were previously difficult or impossible. An example of how students utilized the affordances of the iPad to enhance a team research project was recorded as a student blog post reflecting upon their bus journey project.

> During our experiment at the bus stops we used our iPads messaging capabilities to our advantage as show in the diagram [*Figure 4*] one of us stood down the road and as we saw the bus approaching we messaged the other to trigger the doorbell. The other person filmed the reaction. Altogether we were using three iPads and the speed and reliability just made the whole test easy and simple to do. Initially we thought that we would need walky talkies to communicate but that probably would have looked a bit suspicious and blown our cover. During the experiment we could write down our notes immediately and then copy it straight to our blogs. These iPads are proving to be very useful. (Student blog post, April 2013)

Figure 4 is the students' diagram explaining their use of the iPad to facilitate this on site research experiment.

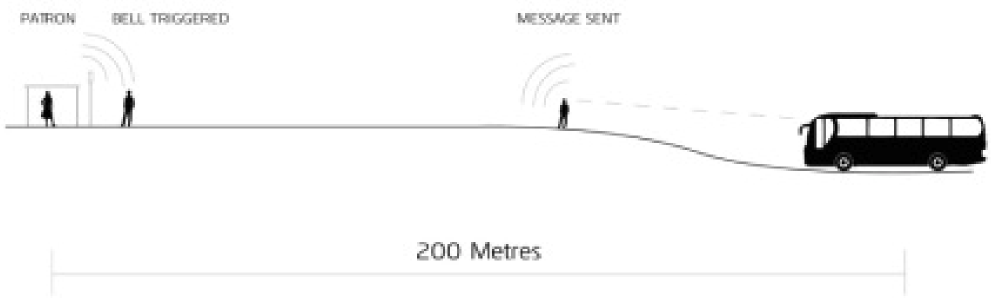

Figure 4: Students using iPads to trigger and test bus arrival alarm system.

Discussion

In this section we discuss some of the identified critical issues around the mobile social media project, and we draw upon our 2013 experience in light of what we have learnt in a variety of mobile social media projects (Cochrane & Withell, 2013; Cochrane & Bateman, 2013; Cochrane, 2012a) to illustrate a social media framework outlined in Table 2.

Critical issues

There were some pragmatic infrastructure issues that needed to be sorted out throughout the implementation of the project, particularly the significant impact of an increased load upon the institution's Wi-Fi infrastructure. The researcher worked with the IT department to enable Airplay protocols on the Wi-Fi network for wireless mirroring during presentations and group work. However there was a significant increase in Wi-Fi devices connecting to the wireless network during semester one 2013, the number of devices doubled across the entire institution in comparison to that recorded at the end of 2012, and the IT department had not anticipated such a heavy increase. This was offset for the project by the allowance of 2GB of 4G data for each of the participating students, which coincided with the rollout of Vodafone New Zealand's 4G network. Where available, 4G connectivity was generally found to be much faster than Wi-Fi, and provided a welcome alternative connectivity option when the institutions server and internet provider crashed early in semester one 2013. The introductory tutorial sessions were voluntary for the participants, and as a consequence only half of the students attended these. It was notable that the students who did attend the tutorials evidenced far more creativity with their iPad use than those who did not attend these sessions. This was documented in reflective blog posts and evidenced in the use of mobile social media for presentations and interaction – whereas the students who attended the tutorials used new presentation tools such as Prezi from their iPads connected wirelessly to the projection system, conversely those students who did not attend the tutorials used PowerPoint from their laptops to present their project proposals and reports. Creating and supporting a new culture around learning and teaching involved a refocus upon ontological pedagogies (Danvers, 2003) that transform students from learning about design principles to becoming active creative designers within an authentic community. This involves moving from simple reproduction of ideas to the reinitiation of design based upon new ideas (Sternberg, Kaufmann & Pretz, 2002). The iPad enabled a shift from the safe walled environment of the design studio into interaction with the environments in which the student design projects were situated.

The iPad project followed a process similar to Puentedura's (2006) SAMR model (Substitution, Augmentation, Modification, Redefinition) of educational technology transformation. Students initially used the iPad to replicate or replace activities they used their laptop computers for, but then progressively found creative affordances that enabled new ways of working that enabled them to modify and even redefine team activities and collaboration. The iPad tutorial sessions explored various ideas for using the iPads for redefining collaboration, and modelled and encouraged students to explore wireless presentation options. The introduction of the MOAs provided the infrastructure that enabled a redefinition of mobile devices from personal devices to become collaboration and group work tools.

The design of wireless collaborative presentation and collaboration workstations for mobile devices resulted in two distinct designs: a wireless projector presentation system nick named R2D2, and a wireless large screen workstation nick named a MOA. The wireless projector presentation systems have replaced dedicated desktop computer systems connected to fixed mounted video projectors in all of the Product Design classrooms and studios. In contrast the MOAs have been explicitly designed to facilitate student team-work enabled by mirroring their mobile devices to a large portable screen that can be wheeled into any space of students' preference. The MOA design team included a post-graduate Product Design student, the course lecturers, and the researcher, resulting in input from all of the stakeholders. The MOA has been tested in several small group collaborative situations, and it has been found to facilitate more of a flexible work-group collaborative environment rather than the presentation centric R2D2 design. Prototypes of both units are shown in Figure 5 (R2D2) and Figure 6 (MOA).

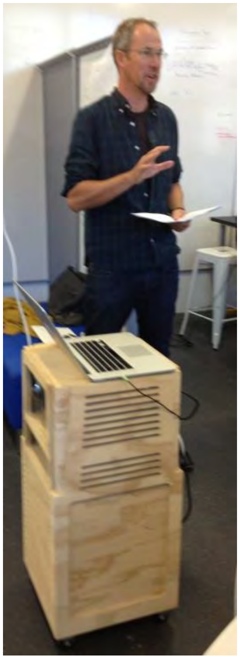

Figure 5: R2D2

Figure 6: MOA

The goal of the Product Design curriculum is to produce creative professionals who employ sustainable and responsible designs, and this requires creative pedagogies (Danvers, 2003, Sternberg et al., 2002). Therefore there is strong affinity with the concept of student-directed learning (heutagogy) within the degree. However introducing student-directed projects requires staging and scaffolding across the three years of the degree (Table 1) as students previous educational experiences are usually heavily teacher-directed. Additionally, student engagement with social media is invariably limited to the use of Facebook, and students require significant modelling of how to utilize mobile social media within a professional framework. The addition of mobile social media into the curriculum has enabled a higher level of student-directed collaboration beyond the studio and classroom that was previously difficult and usually involved a two-step process of documentation followed by reflection and analysis after the event back in the confines of the design studio. While the course has made significant strides in an area that still needs attention is encouraging students to become active participants within a global design community. This is where Google Plus Hangouts and Twitter will become an essential part of their mobile social media toolkit. Currently students are still very focused upon their physical located community based within the Design Studio. One way to model active international participation would be for the lecturers to more explicitly share their international experiences such as involving students in their international conference presentations and inviting virtual community participation via Twitter contacts, inviting and brokering guest international experts to interact via mobile social media with the student projects (Buchem et al., 2012). This would require further conceptual shifts in collaborative curriculum design.

A mobile social media framework

Our mobile social media framework is a mashup of associated frameworks that work together to achieve creative social-cultural pedagogy, mapped onto the pedagogy-andragogy-heutagogy continuum (Luckin et al., 2010). Table 2 provides a summary of the types of changes brought about in the curriculum by the mobile social media framework and provides a potentially transferable mobile social media framework for a variety of contexts.

Table 2: Mobile social media framework and the PAH continuum (modified from Luckin et al., 2010)

	Pedagogy	Andragogy	Heutagogy
Activity Types	• DTT delivered • Digital assessment • Teacher delivered content • Teacher defined projects	• DTT as guide • Digital identity • Student-generated content • Student negotiated teams	• DTT inherent • Digital presence • Student-generated contexts • Student negotiated projects
Locus of control	Teacher	Student	Student
Cognition	Cognitive	Meta-cognitive	Epistemic
SAMR	Substitution & Augmentation • Portfolio to eportfolio • PowerPoint on iPad • Focus on productivity • Mobile device as personal digital assistant and consumption tool	Modification • Reflection as VODCast • Prezi on iPad • New forms of collaboration • Mobile device as content creation and curation tool	Redefinition • In situ reflections • Presentations as dialogue with source material • Community building • Mobile device as collaborative tool
Knowledge production	Subject understanding	Process negotiation	Context shaping
Creativity	Reproduction	Incrementation	Reinitiation
Self perception	Learning about	Learning to become	Active participation within the professional design community

Revisiting Electric Sheep

Rather than providing a distraction for disengaged students, integrating the use of mobile social media into the curriculum has afforded the development of a culture around enabling design thinking and exploring new forms of collaboration. Lectures no longer focus upon talk and chalk, but involve active student engagement on the fly creating opportunities for in class exploration via mobile connectivity, enabling students to share their ideas and discoveries directly from their mobile device wirelessly for the entire class to discuss and critique. Of course this was not an instant process, but is the result of the development of a cultural shift that the lecturers and students have embarked upon, supported by the researchers as technology stewards. Feedback from the staff members teaching into the year three product design studio has indicated that there has been quite an improvement in student engagement, especially during lectures and seminar presentations. For example they commented that the students were now using their iPads to actively follow lecturer presentations 'on the fly' in class as well as presenting their ideas and concepts via Apple TV and the MObile Airplay screens (MOAs) to the rest of the group for feedback. This has allowed for a more interactive and stimulating experience for both staff and students. In addition the Wordpress blogs have been useful to drive student personal reflective practices, with mobile devices allowing immediate and in context reflection. Initial analysis has indicated that students have been more inclined to document and reflect deeply on their work via personal blogs rather than the previously established group electronic portfolios that utilised Mahara. Feedback from students has indicated that the iPads have provided a good, and readily successful platform for blogging, ideation, and collaboration.

Conclusion

Rather than dreaming of electric sheep, the students in our mobile social media project have been dreaming up new ways of collaborating and creative thinking. The impact of the project has been described by the participating lecturers as: “overall quite transformative” and has resulted in significant change within the curriculum with the implementation of new assessment strategies that are no longer physically limited to the design studio, and enabling new forms of student-generated collaboration both in the studio and in authentic contexts. Through designing and deploying a flock of MOAs we have provided a flexible infrastructure to enable student-owned personal devices to be reconceptualised as collaborative team work and presentation tools.

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Reflecting on using a theory seeded methodology for designing and building effective 3D Multi-User Virtual Environments for vocational education

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A design-based theory seeded methodology was used in a pilot study that undertook to develop a 3D multi-user virtual environment (MUVE) for temporary traffic management education. This methodology is a synthesis of educational design-based research and software development practices. However, learning affordances in 3D MUVEs have yet to be considered. Simulation and social communication are treated as essential features that indicate affordances of 3D MUVEs. In the next iteration of the design, social communication activities, and simulation are to be explicitly used in the development of a 3D MUVE to use for training ship's bridge personnel how to communicate on the bridge in emergency situations.

Keywords: Theory seeded, education design-based, methodology, 3D multi-user virtual environment, 3D Virtual World, vocational, and technology.

Introduction

A 3D multi-user virtual environment (MUVE) for creating simulated Temporary Traffic Management (TTM) scenarios was partially developed using a theory seeded methodology (Cochrane, Davis & Morrow, 2013). Two theories were used to seed the design of the 3D MUVE. Legitimate Peripheral Participation (LPP) (Lave & Wenger, 1991), considers participants as they work to become recognized members of a trade, discipline or vocation. Technological Pedagogical Content Knowledge (TPACK) described by Mishra and Koehler (2006), is used to clarify concerns in the application of the digital technology, with pedagogy and content knowledge of traffic management in the design. While these theoretical frames were used as the principle lenses in the development of the 3D MUVE, learning trajectories (Cobb, Confrey, diSessa, Lehrer & Schauble 2003; Hunter, 2006) were also integrated into instruments (for example, semi-structured interviews) that were used to gather requirements and identify needs.

Background: developing the methodology

Plomp (2007) presents educational design based research (DBR) as having three phases, all of which include an essential overarching process that improves the theory base of education. In a preliminary research phase "needs, content analysis, literature review and the development of a conceptual or theoretical frame" (Plomp 2007, p. 15) are undertaken for the study. A prototyping phase in which "iterative design … consisting of iterations, each being a micro-cycle of research with formative evaluation as the most important research activity" (Plomp 2007, p. 15) is undertaken to improve and refine the intervention being designed. This is followed by an assessment phase that undertakes a "(semi-) summative evaluation to conclude whether the solution or intervention meets the pre-determined specifications." (Plomp 2007, p. 15). The final phase can produce recommendations for improvement, hence this phase is called the 'semi-summative phase' (Plomp, 2007). As supported by Dede, Nelson, Ketelhut, Clarke and Bowman (2004), the Design-Based Research Collective (2003) and Reeves (2006), throughout all the research activities: "the researcher or research group will do systematic reflection and documentation to produce the theories or design principles ... as the scientific yield from the research." (Plomp, 2007, p. 15).

Plomp (2007) identifies these phases in a number of DBR projects, including MacKenney's CASCADE-SEA (Computer Assisted Curriculum Analysis, Design and Evaluation for Science (and mathematics) Education in Africa). MacKenney's CASCADE-SEA, as described by Plomp (2007) was used as a basis for the methodology described in Cochrane, et al. (2013). By actively engaging tutor practitioners in a preliminary development phase and in all other phases, MacKenney's process provides for the identification of detailed curriculum by tutors who are in a real-world community of practice or discipline, reflecting a vocational education requirement.

The DBR phases described by Plomp (2007) are similar to phases described for software development. For example, as in an iterative human computer interaction design life-cycle model described by Sharp, Rogers and Preece (2007): identify needs/establish requirements, (re)design, build an interactive version (prototype) and evaluate. Given the similarity between the stages in DBR and generic stages in software development it seems methods and processes used in software development could be applied in the development of educational 3D MUVEs.

The 3D MUVE development methodology, introduced in the pilot study (Cochrane et al., 2013), uses a Scrum based Agile (Clifton & Dunlap, 2003) approach for the development of software components. An Agile approach undertakes development in "short iterative cycles of development driven by product features, periods of reflection and introspection, collaborative decision making, incorporation of rapid feedback and change, and continuous integration of code changes into the system under development"(Nerur, 2005, p. 75). The short cycles are called 'sprints'. The iterative and reflective nature of Agile software development matches the iterative and reflective nature of a DBR project.

Figure 1 depicts the design-based theory seeded methodology used in the pilot study. The methodology follows a process that extends MacKenny's process by putting an emphasis on theoretical outputs and adding Agile sprints for software development.

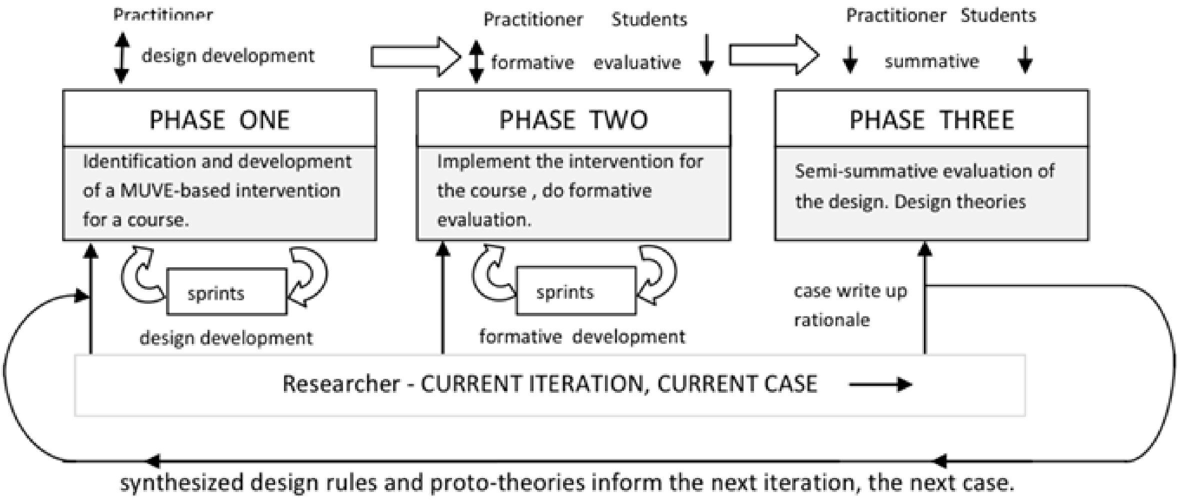

Figure 1. The processes in a methodology for developing educational 3D MUVEs.

Moving towards using affordances as part of the theoretical lens

After using the methodology in a pilot study the authors recognize that the theories applied using the methodology, while educationally appropriate in terms of using technology and for vocational education contexts, do not specifically identify affordances provided by 3D MUVEs. For example, Dalgarno and Lee (2010) identify affordances of 3D Virtual Learning Environments (VLE) in education, of particular interest is "3-D VLEs can be used to facilitate experiential learning tasks that would be impractical or impossible to undertake in the real world" (Dalgarno & Lee, 2010 p.19**)**. In ongoing development characteristics of 3D MUVEs identified by Falconer (2013): social networking and communication, and participation in simulations, are treated as an outcome from affordances provided by 3D MUVEs.

Learning opportunities and situations in 3D MUVEs are not necessarily as a consequence of participation in a simulated situation. Mennecke, Triplett, Hassall and Conde (2010) when discussing a Share Presence theory in the implementation of an educational MUVE describe how even if the domain specific educator was not present in the MUVE, a willing educator present in the MUVE was able to provide students with assistance. Prasolova-Førland (2004) describes a MUVE, called Viras, which was based on a theory that "social awareness" affects the learner's capacity to obtain relevant information. The environment provides seeds for a structure in which members of specific communities are located near to each other, however no specific situation is simulated. The Media Zoo MUVE, as described by Wheeler (2009), was designed for staff at the University Leicester "to experience, interact and understand the potential educational applications of learning technologies" (Wheeler 2009, p. 427). The Media Zoo MUVE does not simulate a real situation for practice, it reproduces an environment to communicate with educators about learning technologies.

By contrast a number of vocational education 3D MUVEs are specifically simulation based. Broadrib and Carter (2009) describe a course where Second Life® was used to role-play office activities. They surveyed participants before and after but even though they found an increase in the capacity of the participants, as far as the learning goals were concerned, they could not attribute this directly to the MUVE. Walker and Rockinson-Szapkiw (2009), describe using Second Life® for education in clinical counselling, suggest that problems with the voice over IP system limits the authenticity of the experience. Vergara, Caudell, Goldsmith, Panaiotis and Alverson (2009) describe the Mr Toma medical simulation, a virtual patient implemented in a MUVE, that they conclude effectively replaces the physical experience with the virtual experience. Furthermore, Gerald and Antonacci (2009) and Hewitt, Spencer, Mirliss and Twal (2009) take the perspective that MUVEs should be used for the development of simulations of authentic situations rather than for constructivist learning experiences.

In the next iteration of the present research a 3D MUVE for a ship's bridge, in which bridge personnel can practice professional communication skills under extreme circumstances is to be developed. In this development social communication, and simulation are to be integral to the design of the requirements analysis instruments and throughout the development processes, alongside LPP and TPACK education theories.

Summary

A pilot 3D MUVE was developed using a developmental DBR methodology. The first use of the methodology did not integrate affordances from 3D MUVEs into the processes. Social communication and simulation are considered to demonstrate affordances of 3D MUVEs, hence these are to be made integral in the design of the instruments to be used in the next developmental case.

A ship's bridge personnel communication training has been selected because it contains strong simulation and communication requirements. This case is also an example of a 3D MUVE that, when implemented, affords experiential learning in situations that are impossible or impractical in the real world, as described by Dalgarno and Lee (2010).

Conclusion

Using a theory-seeded methodology in a DBR project to develop an intervention for a vocational educational context provides appropriate 'tools' for use in the design of real learning situations and also as 'vessel' for research. This design based methodology provides useful stimuli for reflection and development of educational theory, even in the initial stages of the development. Development of this TTM MUVE applied educational theories suited to the education context and also identified requirements for a second case. The next iteration of

DBR will investigate the integration of affordances into the development of an intervention with the 3D MUVE for training ship's bridge personnel in communication on the bridge during emergency situations.

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Motivation and satisfaction for vocational education students using a video annotation tool

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This paper examines the use of a specific contemporary technology in tertiary education that of a video annotation tool, *MAT*, in four vocational learning cohorts. These students, enrolled in property services and audiovisual technology courses, analysed representations of workplace issues in video. These videos included industry interviews, acted examples, and student-performed role-plays. Student analysis was evidenced—and shared with peers and/or teachers—via electronic annotations anchored to key points within the video media. The findings in this paper focus on the motivation and satisfaction of these vocational students in their video annotation activities using Bekele's (2010) conceptual framework of factors attributing to success in online learning. Overall, students' perceptions of this electronic learning method tended to indicate satisfaction across a range of factors, with clues for improvements in tool and/or learning design support, and that the innovation is worthy of ongoing trial and refining from lessons learnt.

Keywords: video annotation, vocational education, property services, audiovisual technology

Introduction

A multiple-case study within an Australian university saw a media (video) annotation tool (*MAT*) introduced across a range of disciplines and tertiary sectors, including four cases from the vocational sector. The four vocational cases comprised three different property services cohorts and one audiovisual technology cohort. *MAT* is a learning tool that allows upload and granular annotation of video. As could be expected, the videos analysed in *MAT* had vocational focus, such as interviews with industry representatives, acted workplace case examples, or student role-play of work roles. See Table 1 for a summary.

Table 1: The four vocational *MAT* cohorts

Code	Level	Case cohort	Subject theme	Video/s for analysis in *MAT*
AV	Diploma	**Audiovisual Technology**	Quality service	2 x commercially acted workplace customer experiences-(examples)
PD	Diploma	**Property Services** (Asset and Facilities Management)	Customer service and leadership	1 x interview; senior industry representative (large company)
PT	Certificate IV	**Property Services - Traineeship** (Operations)	Customer service	3 x interviews; industry representatives (various companies)
PO	Certificate IV	**Property Services – Owners' Corporation** (Specialised)	Conducting meetings	4 x student team role-plays; industry-styled meeting

Annotations were created by selecting and categorising segments of video content, and then adding notes. Where the learning design accorded, this then built into collaborative threaded discussions anchored to the video segments. The audiovisual technology cohort utilised individual student - teacher annotations, while each of the property services cohorts involved small group learning design involving student - student - teacher annotations. All four cohorts analysed their videos in both the physical classroom and the online classroom concurrently (an increasingly accustomed environment), along with opportunities to continue presence in the online classroom beyond the boundaries of the tertiary timetable.

The data that informed the findings involved a triangulation of student pre- and post-surveys, student and teacher interactive process interviews (observation/demonstration and semi-structured interviews), and artefact analysis. The literature framing the vocational cases focused on online learning engagement with content, and content suitable for presentation in video for learning interaction and workforce preparation, such as professional case studies and role play/simulated performance. Synthesis of data presents the findings themed in recognised motivation/success factors (as aligned to Bekele, 2010).

Learning engagement with online content, including video content

Learning generally involves making meaning of learning content, from passive transmission methods through to active consumption such as analysis and discovery learning. Collaborative analysis of learning content has been used successfully in traditional classrooms, and increasingly elaborately in technology-supported learning. An example of classroom collaborative analysis as used by Black (1993) involved students writing their own ideas of a chemical topic, redistributing, then volunteers read out ‘quite good’ examples. This approach gathered momentum with the students “and after pulling three or four answers together with some discussion of the merits of each, the class had developed a very complete understanding of the [chemical] concept … [and] the answers also allowed us to clarify some misconceptions” (Black, 1993, p.143). Educational technology extends the possibilities of content analysis and collaboration:

> Collaborative learning can enhance knowledge acquisition, and, when coupled with the use of digital technology, it can aid in the generation of creative thought processes through the provision of a shared electronic space within which learners are encouraged to take risks, make mistakes and think critically as they work together (Wheeler, Waite and Broomfield, 2002, in John & Wheeler, 2008, p.38).

As others before him, Bekele (2010) recognised that a single factor (such as the educational technology employed, e.g. Kirkwood, 2009) does not alone cause success, but “[p]resumably, technology, course, and support factors mutually affect success measures” (Bekele, 2010, p.118). A meta-analysis study by Bekele (2010) examined 30 published studies for factors of success with online learning environments (with or without a face-to-face learning component). These 30 studies each sought to measure motivation and/or satisfaction. From his findings, Bekele (2010) developed a conceptual framework based on a range of factors he found affected success (see Table 2). Bekele grouped the last four factors together under 'motivation'. Motivation has already been highlighted as a factor for engagement with *MAT* activities in four undergraduate case integrations (see Colasante & Lang, 2012).

Table 2: Bekele (2010) conceptual framework of factors affecting internet-based learning success

Bekele (2010) factors	Detail
Technology factors	technology attributes; student ICT skills, experiences, or views, e.g. technology is easy/friendly; perceived or actual use/function of technologies, e.g. dependable access
Course factors	quality elements in course design, e.g. course relevance, organisation, goal clarity, flexibility; the ‘how’ of learning, e.g. problem based, process oriented
Support factors	technology leadership and support provided by faculty/tutors, administrators, and peers
Task choice	student choice of task(s); availability of ample activities, resources, and technologies to freely choose from; student choice of time and place of learning
Effort	constant challenge and/or effort; need to expend a reasonable amount of effort
Persistence	time spent on-task; continue working despite any obstacles encountered, e.g. technicalities, support systems, group dynamics, and thinking skills obstacles

Achievement	level of achievement; achievement demonstrated via task choice, effort and persistence

Two decades ago educational video was considered expensive, raising the question "could video material provide worthwhile material that could not be provided more cheaply using other media?" (Rowntree 1990, p.256). Early use of video to connect learner and teacher included a "stiff, unemotional 'talking head' of a professor or tutor" (McGreal & Elliott 2008, p.147). Now video is easier to procure and can represent learning content of infinite topics ready for interaction via modern methods, such as individual or collaborative textual annotation (e.g. Rich & Hannafin, 2009). Representation of vocational case examples for analysis, video recordings of student role-play/performance, and granular analysis of video content are discussed below.

Vocational case examples in guided video-case analysis

Authentic case representations – in written, video, or other format – can help to develop and/or apply work-ready skills, such as social interactions, negotiation, problem solving, and critical thinking knowledge and skills (Bennett, et al., 2002). Bennett, Harper, and Hedberg (2002) contrast case-based learning to problem-based learning (which asks students to establish solutions) to that of opportunities to learn from past case experiences of people in their discipline fields. While this may involve experts from the field, Bennett et al (2002) note 'exemplars' or excellent examples are not necessary; rather cases that illustrate "the complexities and contradictions inherent in realistic situations" (Spiro & Jehng, 1990, in Bennett et al., 2002).

Video recordings of student role-play

Facilitating learning via role-play is an established teaching strategy for interactive skill development of interpersonal skills (e.g. for human services professionals, Johnson & Douglas, 2010). It also promotes team decision-making, professional communication, and can help "students develop abilities in problem solving by requiring them to assume different roles and confront unstructured problems in scenarios involving the professional domain of the given role" (Hou, 2012, p.211). Role-play remains important in learning as it offers "a deeper kind of learning … the ability to see the world from different points of view" (Dalziel, 2010, p.56). This deeper learning arises mainly from post role-play reflection (Dalziel, 2010), and video can aid this reflection on role-play (e.g. Walter & Thanasiu, 2011; Robinson, 2007).

Granular analysis of content

Analysis of content, in fine or course granularity, is supported by segmentation of content data into discrete chunks (e.g. Medina & Suthers, 2008). A text-based segmentation example involved postgraduate education students using a wiki to 'sketch-thread-theorise' (Davies, Pantzopoulos & Gray, 2011), where students were asked to note their own professional accounts, highlight key segments and draw out keywords, and then annotate with their reflections and associated theories. This activity was combined with peer contributions and formative feedback, and was found to create "a rich learning environment where professional outcomes were enhanced" (Davies, et al., 2011, p.810). The *MAT* annotation system allows for segmentation of video. For example, undergraduate chiropractic students analysed segments of a videoed chiropractic clinical case by selecting, categorising and adding their reflections and theoretical knowledge to each selected segment (to build clinical notes and a working diagnosis) with largely positive findings (Colasante, Kimpton & Hallam, in press).

Methodology

The methodological approach was via a multiple-case study, with mixed-method data collection. The project sought to examine the use of *MAT* across different industry disciplines and tertiary sectors. Nine class cohorts who identified as using *MAT* for work-relevant themes were invited to participate, four of which were from the vocational sector and form the focus of this paper. Therefore, case selection was purposive as they comprised teachers and students who were (a) early adopters using *MAT* for (b) work-relevant and/or industry partnered themes. Purposively selected cases are recognised particularly in qualitative studies to deliberately select cases or units that can help answer specific research questions (Teddlie & Yu, 2007).

The mixed data collection methods harnessed both qualitative and quantitative data from students and qualitative feedback from teachers. The methodology was trialled in a pilot-case study in preparation for the multiple-case study (Colasante, 2011), therefore, this project benefited from pre-tested instruments following minor design adaptation. Methods included pre- and post-survey, observation/demonstration, interviews, and artefact analysis. University ethics approval was granted to conduct the research.

Data collection

The vocational students using *MAT* were invited to complete a survey in two parts; a questionnaire before using the new tool, and another after. Both questionnaires included primarily quantitative questions (mostly Likert-scaled), and a minority of qualitative questions. The pre-survey established demographic detail and attitudes to online learning, while the post-survey harnessed student opinions of their experiences of learning with *MAT*. Further to this, both students and teachers were invited to participate in individual ‘interactive process interviews’ or IPIs (Colasante, 2011). These involved half-hour observation/demonstration and interview sessions, involving 10-15 minutes of observation while using *MAT* and think-aloud protocol, followed immediately by 10-15 minutes of semi-guided discussion on their experiences using *MAT*. In all vocational cases, the *MAT* activities had concluded by the time of interview, therefore participants were asked to demonstrate and talk-through their activities in the first part of the IPI session. Additionally, student and teacher participants were invited to allow specific *MAT* related learning and assessment artefacts to be used for purposes of the study, to compliment general *MAT* learning analytics (general analytics are used in this paper).

The classes ranged in size from 20 to 39 (sum of 110 students). Student research participation rates (Table 3) ranged from 23 to 69 per cent for the surveys (59 pre-surveys and 37 post-surveys completed across the four cases). Student participation numbers in IPIs were low, however, formed a useful source for clarification.

Table 3: Participation levels in the study

	Class size ^	Pre-surveys completed	Post-surveys completed	IPI participation Students	IPI participation Teachers and Teacher assistant	
AV	39	18 (46%)	13 (33%)	1 student	1 teacher	1 assistant**
PD	22	13 (59%)	5 (23%)	1 student	1 teacher*	1 assistant**
PT	20	8 (40%)	10 (50%)	2 students	1 teacher*	
PO	29	20 (69%)	9 (31%)	2 students	1 teacher*	1 assistant**
Sum	**110**	**59**	**37**	**6**	**3**	

^ Class size represents number of students enrolled, not the number of students who actively attended classes.
* Same property services teacher, therefore IPIs conducted in 1 sitting.
** Same teacher assistant, therefore IPIs conducted in 1 sitting.

Limitations
For ease of comparison between cases, survey data is presented in ‘SSPS valid percentages’, despite some cases having low participation numbers, and each case with at least some non-responses between pre- and post-surveys. With established “evidence that nonresponse can affect survey estimates” (Fowler, 2009, p.54), the percentages represent potentially biased samples of each cohort. The participation rates are given above.

Findings of motivation and satisfaction across the four vocational cases

Data analysis findings from the four vocational cases, one audiovisual technology and three property services cohorts, present here under the Bekele (2010) factors for success with ‘Internet-Supported Learning Environments’ of: technology, course and support factors, and then the four motivation factors of task choice, effort, persistence, and achievement. These factors theme findings from across the data range of student pre- and post-surveys, student and teacher IPIs and general learning artefact analysis harnessed from within *MAT*.

Demographically, the gender mix of respondents across the four cases was predominantly male (approximately 90%) in all but the PO case, which had an almost even mix (53% male). The age range demonstrated a typical post-secondary age range for AV with a minority of mature-aged students, compared to the three property services cohorts, which each represented a mature-aged student base. There was a dominance of EFL (English first language) respondents across the four cases.

Technology factors

Pre-survey data illustrated ICT access to technology and skills and attitudes towards learning with technology across the cases. A majority reported daily access to computers and the Internet while a minority reported access most of the time (5 to 12%) and none reported less frequent access. Self-perceived ICT skill levels were mainly medium to moderately-high.

On whether students liked learning online, the AV cohort gave the strongest positive responses, while most of the property services students liked online learning at least some of the time and a minority (12-15%) not liking online learning (Figure 1). When questioned on willingness to use video in learning (i.e. asked in case specific questions, e.g. AV: "I would like to view customer service techniques via video footage"), there was majority agreement (Figure 2).

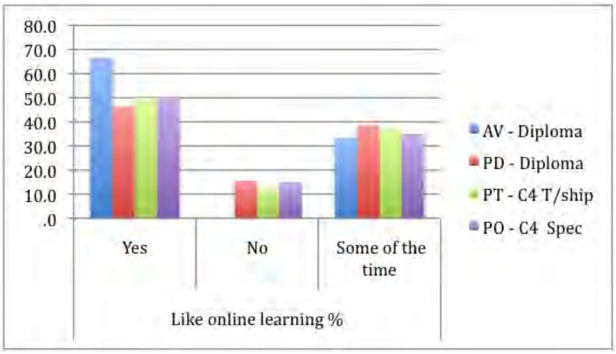

Figure 1: Pre-survey attitude to online learning: like online learning

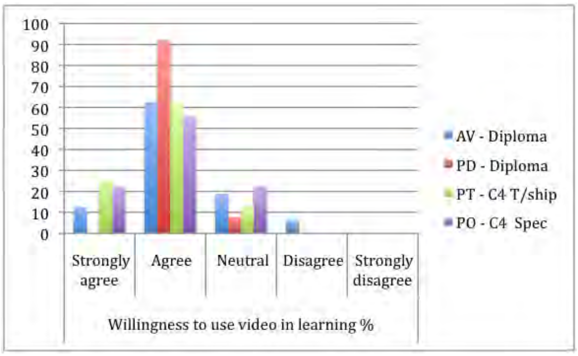

Figure 2: Pre-survey attitude to online learning: willingness to use video in learning

Two related questions (in different sections of the post-survey) directly sought negative reaction to *MAT*. Figures 3 and 4 illustrate that more appreciated the technology of *MAT* than not, indicating not necessarily finding difficulty in use and the technology not interfering with learning.

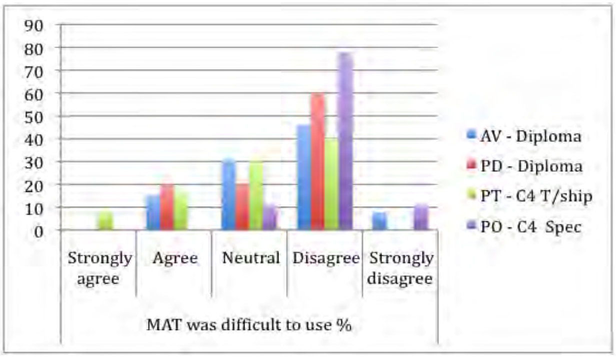

Figure 3: Post-survey attitude to ease of MAT use: difficult to use

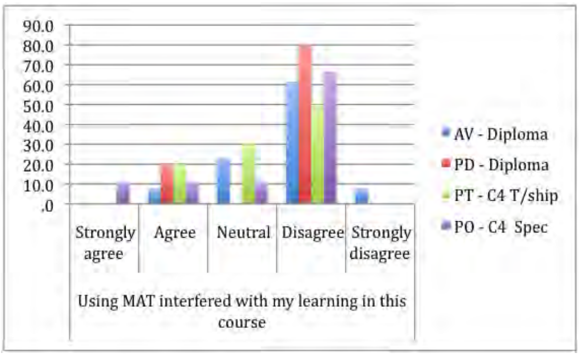

Figure 4: Post-survey attitude to ease of MAT use: interfered with learning

However, to find out where some of the technological issues lay for the minority who didn't indicate satisfaction, the post-survey open responses provided clues such as access, creation of markers and general glitches costing time. Examples of comments included:

- "there was a difficulty in accessing into *MAT* [sic.]. There should be a convenient link to be set up on the website for easier access" (AV)
- "Too many glitches" (AV)
- "if it is only employed once, it would be the learning of a new process, otherwise it is of benefit" (PD)
- "unable to access *MAT* at work or home, frustrated by system" (PT)
- "[difficulty] getting markers to span correct time duration" (PO).

Although these comments represent a small minority, they do provide alerts for future improvements to the tool (some of which have since been implemented), or potential improvements in support mechanisms for students.

Course factors

Outside the vocational cases, analysis of four concurrent higher education (undergraduate) cases of *MAT* use found that course design factors effected student satisfaction. In particular it was noted:

> Higher satisfaction responses by students were presented in *MAT* cases that had some or all of: 1.

[T]eacher presentation and upload of videos in *MAT* (compared to student generation and upload of videos) 2. [T]eacher feedback 3. [L]earner-learner interaction to achieve meaningful goals 4. [F]ormal assessment requirement (Colasante & Lang, 2012, p.462).

All four vocational course designs met these four conditions excepting that while the AV case aimed for meaningful goals, it did not incorporate learner - learner interactions. Note: while each cohort had short time spans to conduct *MAT* activities, most over two to three weeks only, the PD group experienced intensive interaction at their subject's end. Course design features across the four cases are represented in Table 4.

Table 4: Course design factors involving *MAT*

	Learning objective(s)	Individual or group analysis	Teacher feedback	Industry involvement	Assessment
AV	Provide quality service to customers	Individual work	Each student received feedback within *MAT*	Not directly	Formative assessment (summative: role play)
PD	Coordinate customer service activities in the property industry Manage relationships / networks	5 groups Division of labour promoted	Spot checks in *MAT*; whole class feedback and debrief	Video: teacher interviewed industry rep from large facilities management business	Summative assessment (plus reflective journal)
PT	Implement customer service strategies in the property industry Establish networks Manage conflict and disputes	6 groups Division of labour promoted	Spot checks in *MAT*; whole class feedback and debrief	Videos: teacher interviewed three industry reps from various facilities management businesses	Summative assessment (plus reflective journal)
PO	Facilitate meetings in the property industry	4 groups Division of labour promoted	Spot checks in *MAT*; whole class feedback and debrief	Not directly	Summative assessment (plus reflective journal)

Respondent satisfaction of course design features involving *MAT* is illustrated in Figures 5 and 6. AV was the only cohort to report less than 50% satisfaction with access to expert opinion in video. Responses to an open post-survey question "What was it about *MAT* that was least helpful to your learning?" indicated that the AV video content was not as realistic/relevant/accurate as could be.

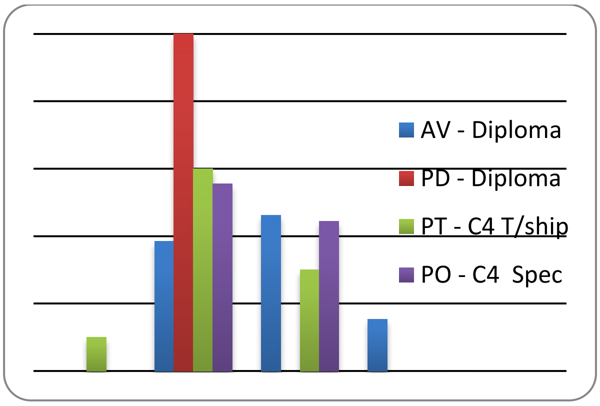

Figure 5: Post-survey satisfaction with course features: access to expert opinion

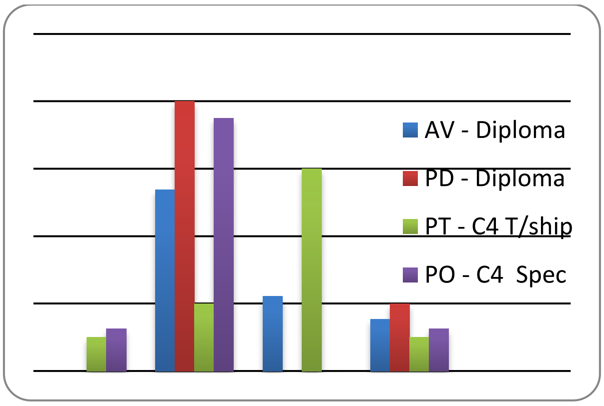

Figure 6: Post-survey satisfaction with course features: activities relevant to workplace practice

PT was the only cohort to report less than 50% satisfaction with activities relevant to workplace practice (fig.6). Neither the open post-survey responses nor the IPIs indicated a major contributing factor for this; there was generally satisfaction apart from technical issues. A high neutral response from the PT cohort may be indicative of the wordiness of the question (or inclusion of the word 'eventual' when already employed in the field). Despite the high neutral PT response, in interview one PT student articulated that he appreciated the video-centred learning compared to traditional learning, including access to the current and relevant practicing expert's input, and learning by discovery:

> [The] process I had to follow was listen to the… [expert in the video who] told you where he worked, how many people were under him, what's critical to… his work environment, what had to be done, what not had to be done [sic.] and how he went about those things… We had to comment on set main headings and then break it down to putting it into our words, instead of the teachers coming up with the handout and saying here this is what it is, listen to this. Which I don't think it really does much because the teachers telling you where all the good points are but… in this you're finding it. (PT Student 2 IPI)

Support factors

The teacher, teaching assistant and student interviews confirmed that support was structured and delivered into each cohort, offering both technical and teaching support for at least the first class in which *MAT* was used. However, in the wider student opinion of the survey, not all explicitly agreed that '*MAT* allowed me to receive encouraging support'. While 62% of the AV respondents agreed, the remaining 38% were neutral; all remaining cohorts had majority neutral responses. The high neutral response may indicate they were unsure what the question meant (i.e. whether it meant technical support or learning support from peers and/or teacher). Upon seeking further articulation on this in the open post-survey questions, only a few AV and PD students provided clues to the ambivalence of the responses. These comments related to class time to support the learning in *MAT* (PD: *MAT* introduced late in subject), and limited collaboration and feedback from others (AV:individual activities). For example, students wrote:

- "no communication" (AV)
- "No feedback as it was last lesson" (PD)
- "Introduction into MAT was brief" (PD).

The teacher assistant interviewed noted that his classroom technical support was most needed in cohorts where students were less technologically able, including the PD students:

> I think I made a difference. Probably most in the… [PD] property services group where the people were least technology savvy and I probably had the least impact in the audiovisual group, where they seemed to be quite fluent. They were a younger demographic in the class and quite tech savvy… They [PD] were an older demographic, I think most of them worked during the day. … A few… didn't even know how to log into the system… I had to be very explicit in all of the directions in… [that] class. (Teacher Assistant IPI)

Task choice

Three themes of student choice emerged within the four vocational cohorts. The first was choice of video for the AV students, where the teacher provided "two videos… [as] it gave students an option to annotate either one" (AV Teacher IPI). The second was the choice of student groups to organise their own division of labour across each of the property services cohorts. For example, for the PT cohort, the teacher "gave them the option, they could either do it [annotate the video] themselves or they could work together in their groups and they could divide up the video and mark a section each or share the markers to mark up… and share the workload", and similarly for the PD cohort. One PD student noted in interview the interrelationships between concepts across the task division:

> my two focuses were 'customer service' and 'relationship building'… [while others had] 'communications' and 'negotiations'. They would find their block [or marker] overlapping with my block because, for instance, [the industry representative] talks about the relationship between the contractor and the consultant, and there is a lot of negotiation and communications involved in working with your consultants and your contractors (PD Student 1 IPI).

The third choice to emerge was the flexibility in annotation approach, e.g. recording the PO meeting minutes:

> They could either do it as they viewed the video in dot points… [finding] a section where something was being discussed and then they could take a minute of it with a dot point highlighted in the video and they progressed throughout the video in that format. Or some of the

students… viewed the whole video and then just stopped it here and there and made some notations of the minutes [external to *MAT*] and then they went back and entered all the minutes in at the end (PO Teacher IPI).

MAT was set up to support both processes, with yellow marker categories, 'Note for minutes', for progressive in-video annotation, and green marker categories, 'Minutes', for summative end-of-video annotation; students could select either option.

Effort

The students who actively participated in *MAT* tended to meet their teacher's expectations of video annotations (according to the teacher IPIs). Table 5 illustrates general *MAT* learning analytics across the cohorts. In particular, it shows the number of students who participated in *MAT* activities, and of those, how many markers were created on average for each student and how many per cohort. The learning design should also be taken into account as regards to the number of markers created, including that the three property services cohorts worked in small groups and were encouraged to task delegate while the audiovisual technology students worked independently.

Table 5: Evidence of student interactions in *MAT* (harnessed by *MAT* learning analytics)

Case	Students active in *MAT*	Markers created: average (range)/student	per cohort
AV	22/39=56%	17 (1-20)	384
PD	16/22=73%	7 (2-14)	116
PT	17/20=85%	9 (1-16)	149
PO	21/29=74%	7 (3-20)	149

During analysis of the general *MAT* artefact analytics, qualitative observations were made of the students' annotations to help contextualise the figures. For the AV cohort, the annotations were mostly short, direct points of observation, although a minority provided more complex single sentences (e.g. drawing cause and effect). For the PD cohort, the total markers per student were not entirely indicative of the amount of work completed, as initial annotations sometimes sparked lengthy discussions in the threaded comment panels. While some students kept annotations to a one-sentence entry, the majority completed detailed and lengthy annotations. For the PT cohort, the majority of annotations and comments appear to be of a reasonable length (in most cases 1-3 sentences). The 'comments' panel featured frequently in this group, with many students commenting on their own or peer's markers. And finally, for the PO cohort, annotations within some markers were dramatically longer than others (e.g. markers under the marker type 'minutes' were mostly several paragraphs in length whereas 'notes for minutes' were generally 1-2 sentences). Consequently, the range quoted above may present a distorted view of and underestimate the amount of work some students achieved.

Persistence

On student persistence, two post-survey open questions yielded examples. One question asked "How did you overcome any challenges that you faced while using *MAT*?". A range of responses to this illustrated that when faced with challenges the AV students solved them by re-attempting the task or restarting the web browser, together with asking their teacher for help or applying to their real-life experiences. The PD students asked others including support staff for help or utilised trial and error as ways to solve challenges. While PT students similarly asked others for help, and employed perseverance to solve challenges, some gave up, e.g. "unable to overcome challenges due to lack of off site access" and "turning the computer off". The PO students asked others for help, or observed what others did, or re-did steps as ways to solve challenges.

Another open question, "From your experience of using *MAT*, what advice would you give to other students who might be about to use it?", also harnessed a range of responses, as summarised here. AV student advice included: follow instructions carefully, think laterally, use good video content, and work through some of the glitches. Some AV students gave *MAT* praise in their responses but one student felt it was pointless. PD, PT and PO respondents encouraged others to give *MAT* a go and to explore its features. Additional encouragement included: it is not hard to use and will help in your learning (PD), and to explore how it can be used in the subject discipline (PT).

Achievement

All IPI participants were asked via semi-structured questioning whether the *MAT* activities helped them to achieve their class' specific intended learning outcome/s. All responded positivity to this achievement; some despite issues (see Table 6).

Table 6: Did *MAT* help students to achieve the specific intended learning outcome/s

IPI	Student (S) and Teacher (T) quotes on achieving intended learning outcome/s
AV S	The video I thought was sometimes a bit vague… in what they were asking you to find and what was actually in [the video] … In terms of the program itself it was very helpful
AV T	…it was a more effective assessment… [and] it's an indicator for me and an indicator for them about how much they know about the subject. So for me to be able to tell really quickly early on in the unit how they are with their customer service knowledge was a really great opportunity to have
PD S	This is a tricky one, 'cause I come from the industry and I'm studying something that I'm working in, a lot of this is now almost innate to me. I regularly work on these principles, so I suppose you could say it was reinforcing that at an academic level
PD T	They had to compare and reflect on it [video interview], I thought that was quite effective and I thought … a lot of learning went into that and hopefully my idea was—and I think it worked—was to work out a best practice strategy, so to use *MAT* very much as a learning tool, from a holistic perspective
PT S-1	You may have whatever knowledge you may have, but if you have someone else's experience it assists in building up that sort of a knowledge, or reinforcing it
PT S-2	It's you who's got to finish that final step and that's the video step, that you're doing the actual thing … this is putting the practical and the theory together … to put it into your own sense or see how other people do it and actually … putting it together, is a good way to know if you're understanding the subject
PT T	Yes they did [achieve] and the idea was that they would reflect on their own knowledge, which I believe they did and compare and contrast if you like what these industry experts were saying
PO S-1	Having a look at the way other people do things, and certainly making comments on other people's groups, makes you take that step back… You don't often get to critique your performance… having a look at how other professional managers do it… we're learning from our peers
PO S-2	You either achieve that or you didn't depending on the situation and the group… the dynamics in the group and whether some people role played more effectively than others
PO T	…with this particular group of students [*MAT* was used] to really provide evidence to me of their already existing skills. Although by viewing another person's meeting and not their own, it really forced a lot of learning and hopefully they all did pick up something that they didn't already know from the other students and so that peer-to-peer learning by viewing other student's video I thought was very positive

Conclusion

Findings from study participants across the four vocational cohorts (audiovisual: AV; property services: PD, PT, PO)—themed to Bekele (2010) conceptual framework factors for success with online learning—showed that for technology factors, a majority found the tool not prohibitive to their learning, although a minority had a few general issues, such as access and delay issues. For course and support factors, there was largely satisfaction, although some dissatisfaction was noted for PD participants regarding *MAT* activities not presented until near the end of their course, and AV respondents regarding quality of videos on offer plus indicators toward the individual approach being a factor. While IT and learning support was offered in all four vocational *MAT* classes, it is unclear whether students overall where satisfied with the learning support offered.

Motivation was encouraged by task choice where students were afforded flexibility via small group task delegation (PD, PT, PO) and choice between two videos to analyse (AV). Student effort was demonstrated via the general learning analytics within *MAT*, illustrating number of markers created supported by descriptors to gain a sense of effort per marker. The students found ways to continue working despite obstacles encountered by using methods such as asking for help, restarting web browser, repeating steps, or persisting in general. Advice respondents would give other students included giving *MAT* a go, explore its features, and follow instructions carefully, and also to think laterally, use good video content, and work through glitches. Achievement towards the various intended learning outcomes—as indicated by student and teacher interviews—tended to be effective, with a couple of qualifiers such as sometimes being more of a reinforcement of knowledge than gaining new knowledge, and despite video quality in AV. Others were enthusiastic in their satisfaction with learning achievements.

Overall, students' perceptions of *MAT* from the four vocational cases indicated majority satisfaction across a range of factors, albeit with clues for improvements in technology and learning design support. This suggests that further trial and examination of *MAT* should occur in the vocational education sector, along with tool improvements and refinement of learning design and support. Detailed models for each of the four cases are currently under construction, in readiness to share with those interested in how learning design might be structured with the use of video annotation tools in vocational education.

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Designing Fieldwork with Mobile Devices for Students of the Urban Environment

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Fieldwork learning frees students from the usual confines of classroom teaching and allows them to undertake relatively independent exploration and reflection. This paper reports on three case studies of attempts to enhance and support student fieldwork through the use of mobile technologies. The studies were conducted with students of the built environment who accessed either specially customised multi-media self-guided directions or pre-existing downloadable apps. The focus in the paper is the design of mobile-supported field activities. Five dimensions that need to be considered are identified: volume of content delivery; extent of data capture; directedness of the learning activity; extent of student collaboration; and strength of link to assessment

Keywords: mobile devices, fieldwork, built environment, directed learning

Mobile devices and tertiary education

The potential value of mobile digital technologies for student education is widely realised and actively under development (e.g., Sharples et. al. 2005). There are now widespread efforts to use smart phones and tablets to enhance lecture theatre experience, to provide administrative support for teaching and learning, and to allow students more convenient access to learning resources at anytime and anywhere. However, there has been relatively little empirical investigation of how to design and use mobile technology to enhance learning activities that have traditionally occurred outside the classroom, namely field trips and other kinds of fieldwork. With notable exceptions (e.g., Dyson et. al. 2009; Bedall-Hill 2011) there have been few reported studies of designing mobile applications to enhance student learning in the field. In this paper, we describe a project with this aim, and report three studies of designing mobile support for students of urban environments, including architecture, landscape architecture and urban design. All three cases set out to situate student learning theory within the experience of what is usually a convoluted reality out in the field.

A review of current literature on the application of mobile devices for mobile learning or 'm-learning', indicates that successful adoption (e.g., Cochrane 2010) has been gradually increasing despite sceptics of this trend (e.g., Traxler 2010). Numerous researchers have advanced various adaptations of mobile technology for educational purposes over the past decade or so (e.g., Sharples 2000; Cochrane and Bateman 2010). These variations will continue to be adapted within the evolving tertiary education landscape, influenced by both new forms of technology and the new expectations and familiarity of successive student cohorts (Albion et. al. 2012; Murphy 2011). However, some researchers argue that mobile devices have so far been mainly used for unidirectional teaching as defined by Berger and Karabenick (2011). Most effort has gone into providing efficient delivery of course content, and to making it conveniently accessible to increasingly "mobile" students (Murphy, 2011). But alongside this practical goal, there is increasing awareness that mobile devices and applications need innovative designs and approaches if they are to genuinely stimulate and inspire active learning within a social collaborative context. To achieve this, it is recognised that more empirical evaluations are needed (McConatha et. al. 2008; Corlett et. al. 2005) including predominantly user reflections (Chang et. al. 2012; Bachfischer et. al. 2008), as to the benefits of the use of mobile devices.

To support traditional field trips and visits through the use of mobile technology can be considered as one part of this move towards m-learning. Fieldwork is valuable for students in many disciplines to develop a practical understanding of concepts and theory. If well-designed, field exercises present an ideal opportunity to create 'authentic' learning experiences of the sort advocated by Herrington and Herrington (2007). Students undertaking fieldwork are not limited by the formal confines of the classroom and can in principle reflect more independently about concepts and ideas, and their application to "messy" reality. Fieldwork-based exercises have been a traditional and fundamental part of learning in many disciplines such as geography (Welsh et. al. 2012; Simm et. al. 2011; Dunphy and Spellman 2009) and biology (Lee et. al. 2011). Dunphy and Spellman (2009) and Stokes et. al. (2011) consider fieldwork to be of intrinsic value and even of necessity to geography students, but at the same time provide cautionary remarks that it does not necessarily provide equal benefit to all students given that a disparate cohort of learners has differing learning styles (Kolb 1984; cited in Dunphy and Spellman 2009). More recently formed disciplines have made less use of fieldwork, although there are some exceptions, for example in information and communication technology (Dyson et. al. 2008).

In this paper, we present initial insights from three case studies of fieldwork supported by mobile technology. Each case study is centred around a particular taught subject, and the investigation covered the design, deployment and evaluation of students using mobile devices in the field. In all cases, students used mobile devices in learning spaces they were required to explore and investigate as part of their study. Although the fieldwork exercise was conducted beyond the fixed space of the classroom in all three cases students' reflections were brought back to tutorials for post-field reflections and analyses within a classroom setting. To evaluate the effectiveness of these exercises students' use of mobile devices was observed in the field and these observations were also supplemented by conducting surveys and interviewing students. While the scope of these case studies was broad, the aim of this paper is to identify the major dimensions that defined our design decision-making process as the exercises were constructed. We present these design dimensions as a resource for educators to consider and apply when they design or evaluate the potential use for mobile-supported fieldwork exercises.

Learning theories for mobile device use

Research into the use of mobile technology in learning has drawn on a variety of theoretical frameworks. These include: active learning (Dyson et. al. 2009), activity theory (Albion et. al. 2012), collaborative learning (Kahn and Chapel 2010; Abrantes and Gouveia 2011; Park 2011); constructivist approaches (e.g., Herrington 2009); and communities of practice (Cochrane and Bateman 2010).

These theoretical frameworks have informed the design of learning activities that utilise mobile devices, ranging from: the earlier PDAs (Alford and Ruocco 2001, Dyson et.al. 2009, Hafeez-Baig et. al. 2006); to the more the recent iPads (Murphy 2011; Kinash et. al. 2012), iPods (Albion et. al. 2012, Jarvis and Dickie 2010); and Smart phones (Cochrane and Bateman 2010, Lee et. al. 2011, Chang et. al. 2012). Wu et. al. (2012) have argued recently that the primary issues of concern when deploying mobile devices for teaching and learning purposes are: the appropriate *design* of the use of mobile devices (Goh et. al. 2012, Dimakopoulos and Magoulas 2009, Roschelle 2003, Sharples et. al. 2002, Vavoula 2010) and *support* for students using mobile devices (Lee et. al. 2011, Costabile et. al. 2008).

Drawing on these established theoretical frameworks brings continuity to the field of m-learning, by emphasising that the challenges for educators are, in part, the long-standing ones of understanding the nature of learning and designing tools to support it (Dyson et. al. 2008a). Equally, the adaptation of the established frameworks in the research cited demonstrates how mobile technologies bring a new terrain in which the traditional concerns of the educator and learner arise in new forms (Kearney et. al. 2012). Theorising allows to see that mobile technologies applied in conjunction with appropriate theoretical frameworks (Ng et. al. 2010) can potentially allow for mobile learning that goes beyond mere 'novelty and convenience value' (Herrington and Herrington 2007). In the case of designing for fieldwork activities, a particular kind of support for learning is needed when students are sent out to the field without supervisory teaching staff. It is this particular challenge that we begin to address in this paper.

The potential uses of mobile devices in fieldwork activities

Mobile technologies are now very versatile computing platforms that offer a range of functionalities to enhance and support fieldwork. Beyond content creation and uni-directional information dissemination in the field, they can, in principle, allow students to gather data and provide a medium for multi-directional interaction between student and teacher, and student to student. We will first briefly review the potentials of this functionality before turning to our project.

Firstly, fieldwork requires ongoing *guidance*, including navigational directions to explore the site, and also instructions on how to carry out learning activities. Existing maps and compass applications, including in-built GPS features, can support this to an extent. In addition, teachers can develop packages of task instructions that can be made available on mobile devices.

Secondly, as with the general approach of m-learning, mobile devices can be used for rich content delivery (e.g., Murphy 2011; Costabile et. al., 2008). However, this has special implications for fieldwork and requires a special form of content. For students to achieve a high level of engagement with their environment, mobile guides might promote greater *interaction* with the objects under observation. For example, the content presented on a mobile device *in situ* can help students to "look with intention" (Sanders 2007, p. 181; cited in Welsh et. al. 2012) to make better sense of the field situation. For the students of the Built Environment studied here, this might be elements of the landscape or buildings encountered.

Thirdly, a mobile device might be used by students for *data capture*: the measurement and recording of the environment, usually for later analyses (Lee et. al. 2011). That is, the mobile device might take the form of an instrument to make measurements of 'objects' under investigation. Fourthly, in a related potential use, the mobile might take the form of a field note-book for students to do *field recording* by logging their activities. Herrington (2009, p. 60) states that 'Fieldwork and excursions were seen as particular contexts in which the affordances for mobile technologies could be exploited. Gathering data in the form of pictures, videos and sound recordings and note taking all appeared valuable activities that supported constructivist based activities set in contexts outside the classroom and lecture theatre.'

A fifth kind of use of mobile technology is to support *collaboration* between students and/or teachers. This might be to share data and learning resources, or to coordinate activities with each other. Recording *in situ* naturally promotes all forms of collaboration, as students can more easily exchange data with their peers by using mobile devices. More collaborative learning activities become possible for the teacher to design. Peer to peer coordination and shared experience can be enhanced in the field through the full range of social media as suggested by Hamid et. al. (2010).

Three case studies of mobile-supported fieldwork

Three subjects formed the focus of the three case studies investigated here. It was recognised early on in the project that when adopting any mobile device for fieldwork teaching and learning, careful consideration must be made for the learning goals of the exercise in order to properly design the use of mobile devices for pedagogical purposes (Kearney et. al. 2012). The circumstances of the three field activities are now briefly described.

Case 1. Environmental site analysis

This study was developed and conducted for third year undergraduate students taking the subject 'Technologies and Environments 3' in the Bachelor of Architecture at Monash University. The intention of the field exercise was to have students work alone without staff present and to work reflectively through the tasks of collecting real data from a physical site. This involved student immersion in the physical experience of day lit spaces and their comparison with numerically expressed light levels and sun angles; reflection on the relationship between physical data and the psychological experience of the dimensions as affected by other variables like surface qualities; considering the use of spaces in the same moment as physical data; and considering the validity, reliability and value of data measurements. Three digital tools were provided to students for the fieldwork exercise: an instruction pack of images as a 'guided tour' through the designated spaces of the exercise; 'LuxMeter Pro' and 'Solmetric' both existing downloadable iPhone and iPad apps that measure light levels and sun path respectively. Sixty students completed the task over a two week period in their own time. During the exercise, observers conducted brief informal interviews with students. In a later tutorial, 31 students completed a questionnaire about their experience and perceived value of the fieldwork exercise.

Case 2. Comparative understanding of historic buildings

This study concerned an iPhone/iPad app walking tour of historic buildings, developed by two of the authors (Lewi and Smith), for second year undergraduate students taking the subject 'Formative Histories' as part of a Bachelor of Environments or a Bachelor of Arts at The University of Melbourne. The downloadable app presented audio and visual materials to in excess of 300 students who toured in small groups without staff. The learning activity was for students to look more intently at buildings *in situ* to make better sense of what they encountered, by overlaying an informed commentary of built features and design concepts and history. An evaluation questionnaire was completed by all students in a later tutorial. The questionnaire probed: the kinds of social interaction students experienced in the task and the perceived value of the exercise and of the different kinds of audio and visual content that was provided.

Case 3. The interpretation of urban landscapes

This study concerned a field site exploration carried out as part of a subject 'History of Landscape Architecture' taken as part of the Master of Landscape Architecture at the University of Melbourne. The students were provided with an in-built iPad app developed by three of the authors (Lewi, Smith and Saniga) which presented audio commentary, historic images and video about 12 designated stops, and a variety of generic resources including a map with GPS location guidance and detailed landform contour maps. A class of 32 students was divided into two groups of 16. Only one group of 16 was split into four groups of 4 students, and each of these groups conducted the field tour using the mobile iPad guide. The 4 groups used a map to find 12 locations in the park. At each location they listened to an audio account. The researchers carried out direct observations of the students conducting fieldwork with the mobile guide (one researcher followed and observed each group). Brief and informal but non-intrusive interviews were carried out with students during the exercise which lasted between 2 to 3 hours. Later, students were given a questionnaire which probed their understanding of the various the tasks, and the perceived value of the overall exercise.

The aim in this paper is to report on the design process that occurred through the design and delivery of the mobile device supported field exercises. The design thinking is captured as five key dimensions that motivated discussion and defined the key decisions made. These are shown in Table 1 which also shows how the three cases varied in terms of each of the dimensions. The dimensions identified are:

The *volume of content delivery*. Mobile devices offer the potential to present encyclopaedic volumes of information. The designer of the field activity must decide whether to provide a great depth and breadth of content or whether to serve more lean activity-oriented material. Great volumes of content may be valuable but also risk distraction and over-focus on the technology relative to the field environment.

Extent of student data capture. As noted, mobile devices can be turned into measuring instruments through specialised apps (as for Case 1). Also, students can gather photographs, videos and notes as field records. The extent of these activities that are demanded by the field activity is a key consideration.

Directedness of learning activity. Putting students into the field is an opportunity to give them a valuable open-ended exploration of a real world situation. However, there is also the risk that they become uncertain about what they are being asked to do, and why it is of value for learning. A key dimension, therefore, is the extent to which mobile guides for fieldwork are prescriptive in directing students in their activity. This dimension refers not to the field activity as a whole, but rather to the part of the activity where the focus of learning takes place.

Extent of student collaboration. Mobile apps may be used to support social interaction between students (as noted above) and also the activities designed into the field activity, and partly embedded in the technology, may demand collaboration between students to varying degrees. This dimension captures the decision of the fieldwork designer about the extent, and also the nature, that this collaboration is demanded or facilitated by the activity.

Strength of link to assessment. The field activity can be designed with varying degree of real or apparent links to students' assessment of their studies. Mobile technologies can play a role in establishing and confirming such links. A direct connection might be an assessable quiz presented on a device. More generally the way the field activity is framed and communicated through mobile tools can strengthen or relax a direct connection to assessment.

	Volume of content delivery	Extent of student data capture	Directedness of learning activity	Extent of student collaboration	Strength of links to assessment
Case1. Light and sun path analysis	Low	High	High	High	High
Case 2. Comparative understanding of historic buildings	High	Low	Medium	Low	Medium
Case 3. Interpretation of historic landscape	High	Medium	Medium	Medium	High

Table 1: The dimensions of designing mobile-supported field activities for each case study.

Having outlined the three cases, we now describe in greater detail how they were shaped by the five dimensions of mobile-supported fieldwork identified and summarised in Table 1.

Design dimensions for mobile device supported fieldwork case studies

Case 1: Environmental site analysis: Design dimensions

The learning context of this case study was environmental qualities, their measures, and their place of increasing importance, because of health concerns and the environmental crisis, within architectural design. The fieldwork required students to conduct intensive measurements of light conditions by using pre-existing apps that could be downloaded to either iPhones or iPads. This case study differed from the other two studies since the collected data were then used as input into a software simulation program for more extensive analyses of light conditions and how these may impact the environmental conditions of a building. Learning about these effects within a lecture context was not possible. Hence the use of the environmentally-aware sensors available on iPhones or iPads meant that students could measure environmental phenomena *in the field*, making the sensed light conditions more apparent. Students worked in groups of 2-4 to measure both the illumination levels and sun angle within 4 designated spaces in the chosen building. The intention of the exercise was to have students work alone without staff present and to work reflectively through the tasks of collecting real data from a physical site. The fieldwork exercise was designed to immerse students within the physical experience of day lit spaces and compare numerically expressed light levels and sun angles with their perception of the phenomena. Table 1 shows how we considered each of the five design dimensions when designing this field activity. Since the mobile devices were used primarily to support the task of *measuring* light levels and sun angles this field activity was considered as being high for the **data capture** design dimension. It was also considered high on the design dimensions of **directedness of learning**, **student collaboration** and **links to assessment** given the nature of the required tasks that were conducted as part of this fieldwork exercise. The level of **content delivery** was considered low. Apart from an instruction pack of images to guide students to the correct spaces under investigation, no other content was made available to support their interaction with the designated spaces.

This case study identified a need to design ways for students to avoid a mechanical completion of the field task and instead to encourage reflective consideration of data meaning and validity. Even though measuring units are essential for design, students were encouraged to better understand what the units mean in relation to bodily perception. This was intended to lead on to a better understanding of how that relationship impacts the way architects think about building design. Since the mobile devices were used primarily as tools to take measurements the need to support stronger interaction with the environment was identified. An aim for the use of devices to measure light levels in student groups was to induce more social and integrated reflection from the students about expected light level readings and how effective they were for the design of the rooms they were investigating. An unintended effect of the field task was that it became a test of understanding of some basic concepts of lighting measurement including luminance. This had been discussed in three of the lectures in the subject. The assignment revealed uncertainty amongst the students on this point and it was realised that stronger consideration is needed for ways of priming students in preceding lectures about the value of the exercise and its integration into lecture content.

Challenges: This case encountered the special difficulties around the use of mobile technologies to guide students to complete a field activity without the presence of a teacher. As with any use of a measuring instrument, the students needed to evaluate the reliability and validity of data collected *in situ* and to experiment with ways of improving these. This is complex for computational measuring tools where the inner workings of the software are opaque. There is currently a limitation to the use of the app chosen in this study for taking light readings. The app did not average the light falling on its surface, but rather analysed what the camera saw, and thus took into account colour and texture. For example pointing the mobile device camera at a black surface would give a different result from a white one and a matte surface would give a different result from a polished one. Without a teacher present to discuss issues of reliability and validity of measurement, many students carried out the tasks with ongoing uncertainty. Another issue encountered is that if hardware is limited, students have to be scheduled on the equipment. This then limits the possibilities of time of day/day of week the exercise may be conducted and other environment conditions may limit the viability of the exercise. For instance, on an overcast day finding the sun angle is difficult to measure. Similarly, access to the designated spaces for the field exercise may be limited to particular times and all of this impacts the possible results.

Case 2: Comparative understanding of historic buildings: Design dimensions

This fieldwork exercise was based on a tour of historic buildings along Collins St in Melbourne using either iPods or iPads on which students download a customised app from the AppStore for free. The intention was to communicate to students aspects of building elements within their historical context and to provide a firsthand experience for students to observe buildings within their street context. Looking at buildings and places *in situ* is a significant and established component of architectural history teaching. In designing this field activity, it was considered as being high for the design dimension of **content delivery**, given the focus on delivering historical information in the form of audio commentary and archival images. Since students were *directed to look* at specific features on buildings, a medium level for **directedness of learning** activity was attributed for that design dimension. That is, there was some degree of freedom for students to shape their own experience of the buildings, but some degree of direction. **Data capture** with the devices was low because apart from students taking the occasional photograph there was no explicit instruction in the field activity for students to record or gather data. The few students who made sketches with an iPad were not considered to be a central part of the main field activity. **Collaboration** is also ranked low because although students toured in groups, the intrinsic task of looking at the buildings was an individual one. A quiz accompanied the fieldwork and was used as a tool to direct student attention and to bring responses back to the classroom to facilitate further discussion and opportunities for learning. The quiz required students to listen to the audio, look at images and to then answer short questions, multiple choice questions, or provide drawn responses. This quiz is directly related to the fieldwork exercise and also provides insights to support the subject's teaching more generally, but forms a fairly minor component in the subject's overall assessment. As such **links to assessment** for this case study were considered as medium.

Challenges: In designing this field activity, it was found valuable to prime students in preceding lectures about the value of the tour and integrate this into the lecture content. A follow up tutorial was also conducted to discuss outcomes and debrief students. It was important that teaching staff, including tutors, were fully aware of the tour and able to communicate its relevance. For this, all teachers completed the tour themselves. From initial student feedback it was realised that audio commentaries should be an appropriate length of time, in most cases less than 2 minutes. Both content and style of delivery in the audio commentaries required careful design. Student preferences were for more building- and design-focus content, and for less general background history. Our response to this so far has been to design audio commentaries around ‘directed looking’ to pick out features of the environment, in the style of a traditional person-guided tour. Keeping the app simple and robust and making it publicly available on the Appstore worked well. However, at the same time the app needs to be tailor made for the particular subject so that, for example, it can include integrated digital assessment options, like a built-in quiz. It is important to use recognised techniques of teaching and learning appropriate and familiar to the subject if the tour is based mostly on the delivery of information. For example in learning about history, using images for context and international comparison, as they are used in lectures. Dealing with very large student numbers leads to constraints in terms of experimentation of design and delivery. The design and delivery motivations are overtly about content delivery; teaching, rather than overtly experimental or participatory in terms of content creation. This is because the app was designed to mimic and enhance an old established mode of fieldwork through a lecturer-led tour. This could have been conceived quite differently, but once embedded in the technological design, it was difficult to change direction.

Case 3: The interpretation of urban landscapes: Design dimensions

This fieldwork exercise was based on a tour of the Royal Botanic Gardens (Melbourne) and surrounding parkland with support through an iPad guide. The intention was to communicate to students aspects of physical change in the shapes and forms that constitute a historic landscape, and to achieve this via first-hand experience coupled with digital resources. The main objective of the use of iPads for this fieldwork exercise was to facilitate the delivery of more extensive visual and auditory materials, to promote new ways of learning while interacting within a site. It was expected that by providing access to images and audio explanations of features at the Royal Botanic Gardens students could better interpret the form and experience of designed landscapes, and the history of design and how this has changed over time. The customised iPad application provides access to standardised content and delivery to all students, thus allowing for a consistent mode of delivery.

A large array of historic images, maps, films and audio commentaries was provided to students in this field activity. Therefore it was considered high for the **content delivery** design dimension. An aim of using the iPads was to investigate the effectiveness of delivering mixed–media resources *in situ*. In particular focusing on photographs and participatory drawing and mapping by students to understand changes in landscapes over time. Given that students made brief records of their observations in the field by *using* the mobile device itself, **data capture** was rated as medium. As with Case 2, students had some freedom in how they observed the various stops in the park, but were nevertheless guided to look at specific features. The interaction of students with their environment was therefore considered as medium on the **directedness of learning**. The design dimension of **collaboration** was also medium given that apart from social interactions with members on their team there was no intrinsic need for collaboration amongst groups. The fieldwork tasks in this case study embedded in the customised app were directly **linked to assessment** exercises and so the field activity was rated as high for this dimension. Previously in this subject, students had often reported in evaluation questionnaires that they valued the presence of the lecturer in the traditional fieldwork excursion, and the dynamic experience this provided. In response, an important objective of this case study was to gauge the extent to which digital media for fieldwork could sustain a positive learning outcome despite the substitution of direct engagement of the teacher with one mediated by digital technology. The aim was to simulate the lecturer's presence while correspondingly advancing the quality and quantity of standardised information that could be provided by digital means that would otherwise not be possible.

Challenges: In our first design for the iPad guide, the lecturer's speaking style in the audio commentaries was found by students to be 'too formal' and out of character. In a second version, we set out to create more informal and even incidental content, as might be delivered by a teacher who is present in the field setting. These subsequent recordings were re-done at the field site, rather than the studio, and with the iPad's in-built recording capacity. This resulted in a less rigid and more personable recording. The lecturer chose a particular view for each stop and rested the iPad in position that captured that view, mimicking the way in which the lecturer would traditionally point out the most significant aspect at each stop. The lecturer then spoke directly into the iPad whilst remaining outside the view frame. This proved to be a success in terms of cost effectiveness (no studio needed), sound quality, and ease of importing the material directly into the iPad platform. The audio/film did not attempt to point at every element at each stop but rather to act as a hinge for incidental experience. This had implications for directed looking – the observation that in practice students spontaneously discovered the ability to align digital content with physical reality.

Further lessons learnt include the need to prime students in preceding lectures about the value of the tour by clearly integrating it into lecture content. Also clearly identified was the value of the full integration of the assignment and its assessment in the structure of the tour. Furthermore, there is the need to use established techniques of teaching and learning appropriate and consistent with methods of historic analysis introduced in the subject's lectures. One of the most critical issues was that of encouraging students to make use of the rich visual materials, within the various folders of historic reference material beyond the material directly related to each stop. In early testing it was noticed that most students did not take up the opportunity to explore the wealth of general learning content about the field site, but rather concentrated on the specific learning materials provided for each designated stop in the tour. This was addressed by re-writing the learning activities in such a way that they required the searching of images or plans in the general resources. This invited detour to find specific pieces of information led students to greater self-initiated exploration of these general learning resources as they carried out the field tasks of the tour.

Insights and reflections on design of mobile fieldwork

We have identified five key dimensions to be considered in the design of student fieldwork supported by mobile technology (see Table 1). The intention is not that all such fieldwork should be high on all five dimensions, but rather that the designers of field activities should be deliberative about where their activity falls on each dimension, rather than leaving it to accidental factors. Table 1 shows how our three cases studies of designing mobile-supported fieldwork can be described as low, medium and high on each dimension. For each of our three cases, for example, an active decision was made about the volume of content to be delivered. In case study 1, it was judged that the volume should be low, so that students might concentrate on carrying out field tasks. In contrast, for cases 2 and 3 it was a key intention that students should receive rich volumes of content *in situ*. Even in these latter cases, however, it was an important design intention not to flood students with rich multi-media, but rather to deliver a series of context relevant content. In case 3, students were also provided with a wealth of general learning content but students made relatively little use of them until 'reasons' to use them were introduced.

All of the case studies demonstrated that, despite the potential of mobile technologies to contain full instructions, there is a continuing need to make explicit to students before they go out to the field about why and how the mobile devices can support their learning experience. Even with this briefing, clear directions in mobile apps are needed by students to help them retain the purpose of the activity. For cases 2 and 3, the production of a mobile app as part of the teaching and learning 'toolset' required significant additional resources of both expertise and time. In case 3, clear guidelines for assessment deliverables, templates for submissions, example materials and carefully phased tasks were assembled for the fieldwork. Tutorial sessions also focused on providing feedback to students about the activities and expected submissions.

An issue encountered across the three studies was the need to carefully define the field areas within which students should work. This becomes important when students, armed with mobile apps, are free to conduct the exercise at any time. For example, accessibility to sites inside buildings raised issues for case study 1. Furthermore, the ability for students to engage with multiple sites through the use of apps, and for that to be undertaken within a reasonable time period, meant placing restrictions on the study areas. Similar issues were encountered for the access to equipment. While it cannot be assumed, it is increasingly true that students bring their own mobile devices. However, developing apps that run consistently across all, or even most, platforms is difficult and significantly increases the cost for educators. Providing basic mobile devices can still be a cheaper and more reliable and equitable option.

A significant issue across all three cases presented here related to the design dimension of collaboration. There was always the need to carefully consider the socialisation of learning, and the inherent pitfalls in isolating students from each other as they might focus on the devices rather than on insights with their peers or the fieldwork sites. While it is simpler to design a learning activity that can be carried out by an individual, there are potential benefits in designing a group task with designated roles. Collaboration amongst students can be further promoted by designing exercises that require students to share data and reflections they make on mobile devices whilst conducting fieldwork. These techniques embed social interaction and the opportunity for more socially-constructed learning in the tasks and mobile tools. As observed in case 1, however, a designed collaboration can sometimes lead to a mechanical division of labour between students and insufficient reflection on the structure of the larger field activity.

An important factor in student reception of mobile-supported fieldwork is the way the exercise and technology is framed in relation to the delivery of the subject as a whole. One danger is to frame the mobile device for students as something 'instead of' rather than 'in addition to' the involvement of the teacher; as observed in case study 3. A key lesson learned from all three cases was the need to prime students in preceding lectures about the value of the fieldwork exercise with the mobile devices and integrate this into the lecture content. It is desirable for content presented in a mobile app to be commensurate and continuous with material presented in class. There was also a need to allow sufficient time for students to complete activities both in and away from the field. All of these points were considered and addressed to an extent in the three case studies presented here while further improvements could be made. Nevertheless, despite all of these issues leading to less than perfect learning experiences, student reception and perceived value of our three mobile-supported exercises was generally positive. Observations of students confirmed that they carried out the tasks in the way intended, although the need for improvements and further more explicit directions or new forms of content was always apparent.

In addition to these points of learning design, there are a host of practical issues around mobile-supported fieldwork that should be mentioned. Significant problems can be screen glare in outside settings as well as audio levels and background noise. However, after some experimentation with recording levels, both the iPad and iPod Touch apps had ample volume to cope with most situations. As an overall practical note, it is important to not underestimate the time needed to create an app, and to consider developing and using the app over a number of semesters to get back value out of this development. Finally, safety concerns for fieldwork are also very real. Crossing a street, for example, whilst watching or listening to content on a mobile device brings the risk of harm. Prominent directions to safety should be built into apps and reinforced through student briefings.

In summary, mobile-supported fieldwork is a significant design and development challenge for teachers and institutions, but offers great potential. Mobile technology brings the versatility to instruct students, to provide rich and extensive content, and to provide various tools to record, measure and collaborate. Armed with mobile tools, students can be given greater freedom to explore and learn without the ongoing presence of a teacher. The three reported case studies have shown that it is possible but not straightforward to achieve this freedom and retain learning value. The five design dimensions presented here offer one view of the design decisions that underpin the achievement of these goals and the delivery of mobile-supported fieldwork.

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Student reflections on preference and use of lecture notes and recordings

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This study examines feedback from students about the use of Tablet PC technology in material science lectures to help us understand how students use available learning resources and to inform the creation of future materials. Students commented on their preferences for being given full notes or partial notes which were annotated during the lectures and also on how they used notes and recordings in their learning. Students presented conflicting views on which style of note-taking they preferred with a varied range of reasons for their preferences. Feedback indicated that students perceive that live lectures are important and that the distribution of complete notes and recordings were useful as revision aids and if missing a lecture was unavoidable. Suggestions were made that the technology could also be used to produce podcasts of key points and videos of demonstrations performed in lectures.

Keywords: Annotated notes, asynchronous, learning management system, Tablet PC, perceptions

Introduction

This study explores the effective use of technology using a tablet computer with a digital stylus in a large, compulsory, first year engineering subject *Materials and Processes*. The project aimed to 'understand our present' by evaluating the student's perceptions of their learning environment and their preferred delivery mode, and, specifically, to evaluate the effectiveness of electronic handwriting (e-inking) from the learning and teaching perspective. This study was conducted in conjunction with a faculty-wide program where Tablet PCs and support were given to lecturers to increase interactivity in the lecture environment.

Tablet PC technology, which allows handwritten annotations to be projected and saved, is no longer novel and has been implemented in a variety of ways in higher education teaching. Tablet PCs have been shown to improve the instructor-learner dialogue in projected presentations with associated note-taking (Colwell, 2004) and are part of the technology-rich learning environments (Galligan, Loch, McDonald, & Taylor, 2010; Garrick, Villasmil, Dell, & Hart, 2013).

Many current university students belong to the Net Generation (Judd & Kennedy, 2011; Kennedy et al., 2009). At the University where this study was conducted, the majority of first year students (~ 80%) are part of the Net Generation. They have been brought up in a world where information technology is integrated into their lifestyle. Their use and familiarity with a variety of information technology communication devices has necessitated the delivery of instructional material at tertiary level to be commensurate with the student's own portable electronic devices (Hamilton & Tee, 2010; Skene, Cluett, & Hogan, 2007).

A Learning Management System (LMS) was used for asynchronous delivery of both the teaching material and recordings of the lecture process. This resulted in a blended learning program to extend the classroom experience into a multimedia environment.

Students vary significantly in their approaches to studying and learning and even have different perceptions of how to approach the same course (Felder & Silverman, 1988). It has been suggested that lecturers take into account students' previous experiences in the academic environment to determine and implement appropriate subject delivery methods (Prosser & Trigwell, 1999; Trigwell, Prosser, & Waterhouse, 1999).

Being exposed to modern computer based technology, with a Tablet PC, LMS and recordings for asynchronous learning in the university environment, is new to many of the student cohort, (Blicblau & Pocknee, 2003; Brodie & Loch, 2009).

The quality of student note taking is dependent on their engagement and it has been observed that, in science classes, many students are not effective note-takers (P.-H. Chen, 2012; Peper & Mayer, 1986). To ameliorate the effect of ineffective note taking, a number of material delivery methods have been suggested, including pre-class full notes (J. Chen & Lin, 2008), pre-class partial or "gap" notes, post class full notes and recorded classes with a variety of notes, (Cornelius & Owen-DeSchryver, 2008; Kinchin, 2006; Marsh & Sink, 2010). The outcomes from these studies suggested that students receiving partial notes performed better on examinations later in the semester and on conceptual questions during the cumulative final examination than students receiving full notes. The benefits of learning with partial notes on improving student outcomes have been equivocal. This paper does not scrutinize outcomes in terms of examination results, but instead focusses on the students' perceptions of the technology, their preferences in how information is disseminated and how they use the different teaching materials produced in their learning.

Research Methods

Materials and Processes is a 12-week subject run across an academic semester by two lecturers that team-teach. Simon and Jon each take 6 lectures, and employed the same Tablet PC technology and provided students with notes using PowerPoint. Jon provided students with a full set of notes, however Simon provided the students with partial notes, which he filled with e-ink (annotating on a Tablet PC with a digital stylus) as the lecture progressed. At the end of the lecture, Simon provided students with a full set of annotated notes from the lecturer and placed the file on the LMS for dissemination.

At the end of the semester, and prior to exams, all students enrolled in this subject in both Semesters 1 and 2 were asked to voluntarily complete an anonymous paper-based questionnaire which had been approved by the University ethics committee. A quantitative methodology was employed comprising of a questionnaire with 20 questions and opportunities for participants to provide qualitative responses. This instrument contained multiple choice and open-ended questions. As the unit was repeated in both semesters, the questionnaire was distributed to two different cohorts of students. Participants were assured that the results of the study would be solely used for research purposes to improve the teaching and learning methodology, and would have no effect on their current or final results according to ethics approval.

In total, 103 students participated and completed the questionnaire. This data was combined from semester one (n=72) and semester two (n=31). In semester 1, there was a higher participation rate (48%) than in the second semester (21%). This can be contributed to research fatigue experienced by students who have been over committed (Clark, 2008; Schuh, 2009). The analysis was guided by the following overarching research themes that emerged out of the issues presented in the introduction:

- Student perceptions of the subject delivery employing a Tablet PC as an engagement tool in the learning of lecture material
- The perceptions of students in the use of partial/annotated notes as an aid to learning compared to full set of notes,
- Student perceptions of the benefits of accessing complete lectures asynchronously as an aid to learning.

The research team met regularly and discussed the analysis of data several times to ensure internal validity of the process and agreement about the interpretation. Entries to survey tick data were compiled to provide quantitative data. Free text entries were read repeatedly to enable the coding and categorisation of responses, then counted to enable quantitative comparisons. This qualitative data analysis method was informed by the work of Boyatzis (1998) and Bogdan and Bicklen (2007).

Results and Discussion

After the end of the lectures all annotated slides as *pdf* notes were uploaded to the LMS for Simon's section of the course whereas Jon's complete notes were already available on the LMS. Students were asked if annotations were being made available to them after class, of which 94.6% per cent said yes, while the remaining 5.4% were unaware of this learning resource. Students who commented on how they used the annotated notes (n=25) stated they mostly used them for revision or if they had missed a lecture (Figure 1).

Lectopia is a lecture capture and delivery system which records presentation slides, lecturer delivery and any student audio interactions. Lectopia recordings of the lectures were also made available to students using the LMS, with 55% of students surveyed having used them in some way. Their comments indicated that they used Lectopia recordings in much the same way they use the annotated notes, namely to revise and catch up on work from missed lectures. The key difference between how the resources were used is that recordings were primarily viewed as a means of catching up on missed lectures, whereas the provision of annotated notes was seen as a revision tool.

An additional and unexpected use of the recordings was that students used them to better view graphs and diagrams which were not clear when viewed on the screen and most likely too small when printed in the notes. This should be considered further when identifying topics for potential podcasts. It may be that short videos explaining diagrams which can be zoomed in on could be greatly beneficial to students who strain to see the subtleties of a particular chart during a lecture.

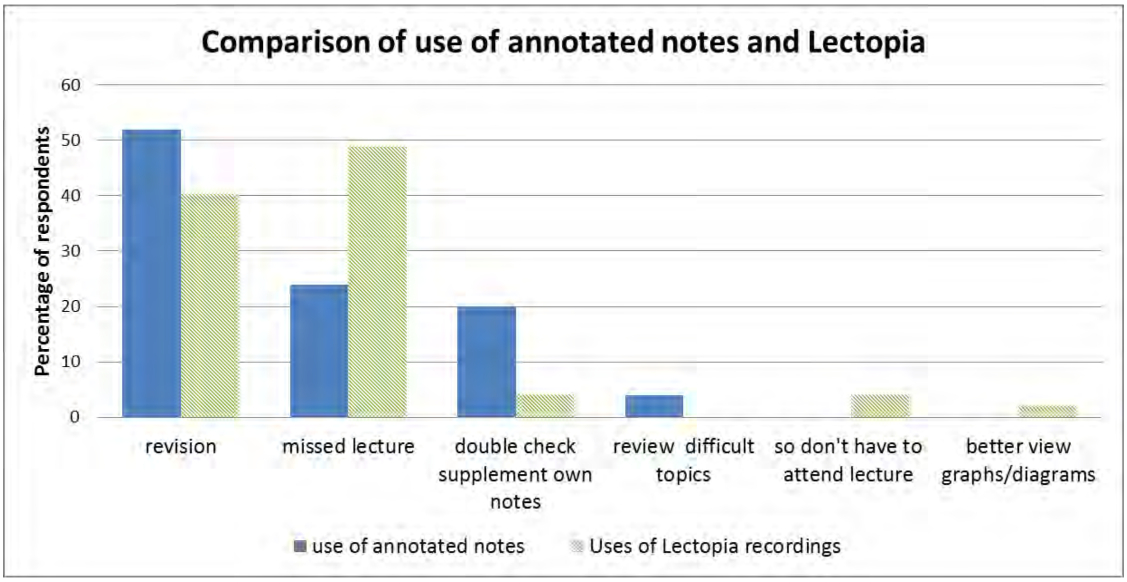


Figure 1: How students used annotated notes and Lectopia recordings in their learning

Only a very small minority (4%) used the recordings as a substitute for lecture attendance. One student explicitly stated "I only use them when I am unable to attend. There is no substitute to actually going." Even with the availability of recordings, attendance at the lectures was preferable. Viewing recordings provided students with the ability to fit their learning around their own schedule. "There is a 8.30 lecture on Fridays my only class on a Friday. I watch the lecture at home rather than going." These comments emphasise that students value attending lectures, but use recordings to supplement their learning.

Accessing the recordings and notes through the LMS allowed students to study off campus and at a time which suits them (asynchronously), with students commenting that they access the notes to "read on train" or download the recordings and "read on phone, take to work". This portability and flexibility of learning resources is an important addition to the traditional lecture with online learning materials making it possible for students to take control of how, when and where they study.

Students were asked about their preference of annotated (partial lecture notes) as can be seen in Figure 2. Just over 50% of students preferred annotated notes compared to a complete set of notes.

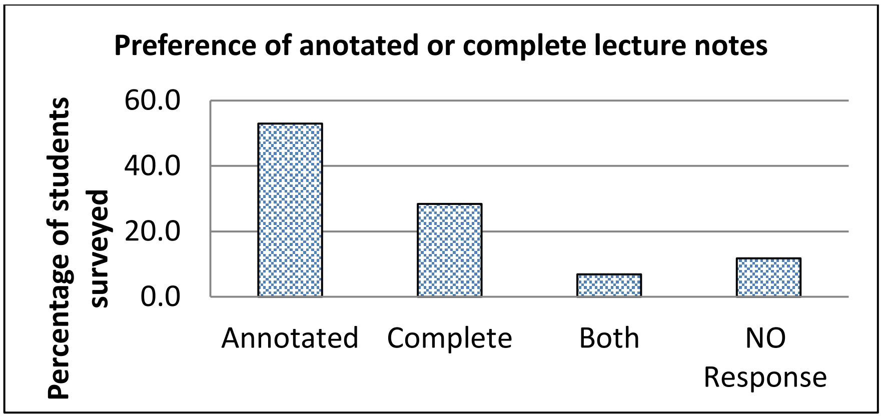
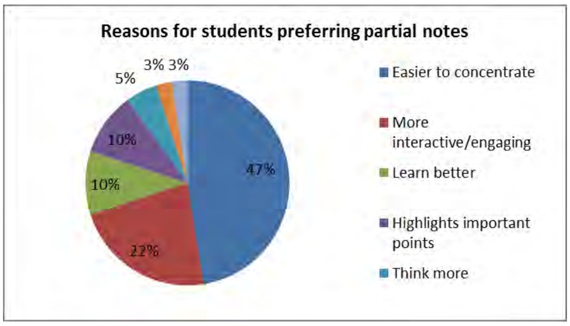


Figure 2: Student preferences for annotated or complete notes

There were many reasons for different preferences for a particular style of note giving as can be been seen in Figure 3. Of the student cohort that responded, 47% found that annotated notes allowed them to concentrate more easily, 22% stated that lectures were more interactive and engaging when slides were annotated during lectures and 10% stated that they learnt better and this style of learning directed them to important points. A student who was clearly in favour of annotated notes stated "usually the annotation half is the most critical of the notes," and this was supported by another student, "I like annotations of the lecture because it made you participate, read and actually learn". However, some students realised the limitations of the use of this style of lecturing and criticised this approach, "annotations keeps you focussed but sometimes moves too quickly and I don't have time to copy". The majority of those who preferred annotated notes did so because it kept them active during the lecture making it easier to stay focused on what was being said and ultimately helping them to learn better.



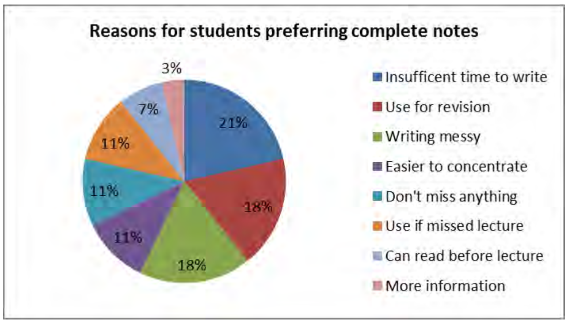


Figure 3: Reasons given by students for their preference of lecture handouts.

Of the students who preferred being given complete notes, 21% believed they could not keep up with the lecturer, having insufficient time to write every detail down. This was noted by a student who said "some slides are gone through too quickly to finish annotations as well as take in information." Students also perceived that complete notes contained more information and prevented them missing anything during the lecture. One student stated that the preference was for full notes "because then you don't miss any essential information." Some students also benefitted from being able to access the complete notes before the lecture and not just having the annotated version available afterwards as students used the notes to "read ahead and look back as well." Another student mentioned that complete lecture notes allow you to "focus more on what's being said instead of writing things down." The majority of those who preferred completed notes did so because of the *fear of missing out.*

Futures

In addition to recording of lectures, students were asked to comment on other potential uses of the Tablet PC technology in the teaching of *Materials and Processes*, viz.

- Podcasts of key concepts
- Links to videos of theory being applied in real life
- Videos of tutorial questions
- Recording of demos/props used in lectures

Students suggested that recording technology could also be used to produce podcasts of prop demonstrations performed in lectures as active demonstrations are a substantial and popular part of this particular lecture course. These demonstrations are not currently captured by Lectopia or other screen recording software (e.g. Camtasia). It is worth noting that these students would have been exposed to screen casts through their Maths course (McLoughlin & Loch, 2012). It appears that the students find them helpful for their understanding and memory, and wish to re-watch them when revising their work. The recording of demonstrations and their impact on learning is something to be investigated in future work.

Concluding Remarks

Student feedback indicated that live lectures are important to their learning. The distribution of complete notes and recordings were useful if missing a lecture and as an aid to revision. The process of annotating partial notes during a lecture was viewed as making it easier to concentrate on the lecture, and even making it more engaging.

In conclusion it appears from this study that the use of Tablet PCs for annotating slides during a live lecture and making the annotations available online is useful for students. They use the annotated notes to double check their own notes and for revision. Recordings of the lectures were primarily used to catch up on missed lectures. These resources provide students with the flexibility to engage in learning at a time that is convenient to them and they suggest that more are made available in the future.

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Dynamic digital posters: Making the most of collaborative learning spaces

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Academic and professional staff at Queensland University of Technology (QUT) have been faced with the challenge of how to create engaging student experiences in collaborative learning spaces. In 2013 a new Bachelor of Science course was implemented focusing on inquiry-based, collaborative and active learning. Student groups in two of the first year units carried out a poster assessment task. This paper provides a preliminary evaluation of the assessment approach used, whereby students created dynamic digital posters to capitalise on the affordances of the learning space.

Keywords: digital posters, learning spaces, blended learning, learning design, student engagement

Introduction

Dealing successfully with changes to curriculum to be implemented in new collaborative learning spaces can be very challenging for academic staff. This is especially true if staff have not had significant involvement in the design process. Importantly, they may feel unprepared to take advantage of the affordances of technology enriched spaces and might have little time to develop understandings and skills of how to do so (Steel & Andrews, 2012; Jeffrey, Milne, Suddaby, & Higgins, 2012).

In 2012, academic staff in the Science and Engineering Faculty (SEF) were involved in preparing to deliver a new Bachelor of Science course for Semester 1, 2013. The curriculum stressed the need for a variety of blended learning approaches over more traditional ones. The four new first year units were to focus on:

- inquiry-based, experiential, exploratory, peer-to-peer and collaborative learning (and avoid long lectures)
- group work and group assessment, peer-to-peer learning and formative feedback (and avoid examinations).

All group work activities were to be carried out in collaborative learning spaces in the new Science and Engineering Centre (see http://www2.qut.edu.au/sci-eng-centre/) and the spaces were ready for use from the start of 2013.

To cope with the choices and decisions to be made, academic teams need guidance and assistance with integrating technology into learning and teaching, developing a variety of effective assessment methods, and preparing students for technology in the workplace (Diaz, Garret, Kinley, Moore, Schwartz, & Kohrman, 2009). To become skilled practitioners in e-pedagogy, both initial staff training and continuing professional development is advisable (JISC, 2009). The Learning and Teaching in Collaborative Environments (LATICE) Project at QUT has partly addressed the need for professional development by facilitating the exploration of learning design solutions that are reusable, sustainable and scalable. As part of this project, one of the authors coordinated a program for SEF staff that followed an academic development model proposed by Steel and Andrews (2012). The program modelled inquiry-based learning in collaborative learning spaces, and the participants experienced, designed and practiced teaching activities. Through investigating a group poster assessment task, participants critically reviewed the suitability of creating and assessing digital posters using Google Sites. Feedback was positive including: *'this is a brilliant mode to encourage collaborative learning and collaborative assessment'* and *'it was a real eye opener … a really useful reconceptualisation'*.

Unit coordinators then evaluated this approach and decided to adopt it for two first year science units in Semester 1, 2013 (with approximately 360 students per unit). This paper provides a preliminary evaluation of the use of digital posters in one of the units. It is intended that the findings will help develop a common approach for the Bachelor of Science course (since two second semester units will also require that students produce a digital poster) and could be useful for other units taught in collaborative learning spaces.

Blended learning environment

The digital posters approach was developed by considering the pedagogical requirements of a group assessment task for a poster, the affordances of the collaborative learning space and then identifying potential benefits of using digital posters and more specifically, Google Sites.

Pedagogical considerations

Recent work on threshold concepts in science that focus on authentic learning has influenced curriculum design at QUT. For example, Jones and Yates (2011, p. 26) suggest that Chemistry graduates should be able to communicate to their peers, to chemistry and scientific non-experts, and to the general community using a range of media (including written, oral and visual media) and include a range of formats such as posters.

Developing understanding and skills in poster creation has a number benefits for students: posters can facilitate the rapid communication of scientific ideas, visually represent ideas, stimulate an exchange of ideas between the presenter and the audience reading the poster, be a summary of work done, be viewed when the author is not present, and allow for valuable networking opportunities (Hofmann, 2010, p. 499; The University of Adelaide, 2009). From a learning and teaching perspective, they have the potential for creativity and originality, reliable and fast marking, active learning, peer assessment, can promote positive attitudes in students, and also help students to explore and confront misconceptions about a topic (Curtin Teaching and Learning, 2010; Berry & Houston, 1995). However, there are possible disadvantages in that students can focus unduly on presentation rather than content or understanding, finished posters might be very different thus making comparison difficult, and they could require additional resources (Curtin Teaching and Learning, 2010).

Technology and space considerations

The collaborative learning spaces in the Science and Engineering Centre can be viewed from the Learning Spaces Tool (see http://www.itservices.qut.edu.au/generalservices/lets/learningspaces.jsp and search for *Space Type = Collaborative Learning Space > GP — P Block*). Central to the success of collaborative learning spaces has been the use of 'Computers on Wheels' (CoWs) with touch screens, portable whiteboards, and moveable (wheeled) tables and chairs. A space typically has nine CoWs, with two tables and six chairs per CoW for a total capacity of 54 students. Also, by opening central glass doors, pairs of adjoining spaces can be used as one space.

Poster-related activities were designed for each student team to work from a CoW (that is, their 'digital hearth'), connect mobile devices or use cloud-based apps if necessary, and obtain ongoing formative feedback from academic staff and other team members. This was to culminate in all teams presenting their final digital posters from a CoW in the collaborative learning space (that is, to simulate a conference poster session) and being assessed by their peers.

Reasons for using a digital poster

When creating a printed poster (for example, in the way outlined by O'Neill & Jennings, 2012), students need to have access to suitable resources such as relevant types of software and printing facilities. However, one of the main reasons for creating digital posters is that students more likely need to develop information literacy skills rather than desktop publishing and printing skills. JISC (2009) state that this involves developing skills and understanding of how to search, authenticate, critically evaluate and attribute online material as well as develop 'web awareness' to operate as informed users of web-based services.

Digital posters offer distinct advantages. Hai-Jew (2012), who outlines the use of digital poster types for virtual conferences, argues that digital posters enable wider audience reach than is possible during face-to-face conferences (for example, to generate interest prior to, enhance synchronous presentations during, and be accessed for deeper analysis and learning after the conference). They can include combinations of dynamic multimedia rather than static content, and allow for the audience to interact with the poster to perhaps share new knowledge online instead of being passive consumers of information. The possible interaction between digital poster author(s) and audience is an important one. Creating a poster for an authentic audience can 'up the stakes' by adding to the authenticity of the student project and help increase students' motivation to produce work of high quality (Buck Institute of Education, 2013).

In summary, creating a digital poster has the potential to enhance student engagement. By considering suitable blended learning engagement strategies, the assessment task could be one that students perceive as authentic and challenging (that is, the approach may be new and so stretch their performance), could enable timely and elaborated feedback from academic staff and peers, and could help academic staff monitor student work and identify students at risk (Jeffrey et al., 2012).

Expected benefits of a Google Sites approach

From the author's own experience of using Google Sites as well as that of other QUT academic and professional staff, these potential benefits were identified at the start of semester:

- It is relatively easy to create a layout for one poster page, add content and edit.
- Content can be either static (text and images) or dynamic (links, videos, slide shows and maps) to encourage interaction from a presenter and an audience in the collaborative learning space.
- Different kinds of sharing can also occur, such as between team members to build the poster, with academic staff for formative feedback, presenting to other teams for peer assessment, or making the site available for showcase events. Furthermore, the sharing of a Google Site is very similar to that for Google Drive, which staff and students might already be familiar with.
- Students can carry out work on the poster synchronously and asynchronously (although only one person can edit a Google Site page at one time).

Evaluation

For one of the first year Bachelor of Science units, students were required to select one of four challenge groups to participate in during the semester. Students from one of these challenge groups took part in this digital posters evaluation. Each of the 84 students in this group consented to having their group poster evaluated for this study and of this number, 50 completed a survey voluntarily. There were 17 student teams ranging in size from 3 to 6 people, and 12 of these teams used Google Sites to create the poster (whereas other teams decided to select Prezi or PowerPoint). Four academic staff completed a similar survey. Note that this group of students was selected since the academic team leader had participated in the 2012 LATICE Project workshop series and was familiar with the Google Sites approach.

Both staff and students needed to develop skills and understanding of creating a digital poster using Google Sites. Only some academic staff had attended the LATICE workshops in 2012; therefore, the unit coordinators and team leaders as well as available tutors attended training in the week before semester commenced. Ad hoc support was further provided by the author during the semester as needed. The author produced a guide for creating, sharing, presenting and submitting a digital poster for assessment and this was referred to as required by academic staff and students (see http://goo.gl/Y84gw, an example digital poster for ascilite 2013 providing links to the guide and exemplar posters).

Findings

The student survey focused on how easy it was for students to create the poster, include relevant content, be creative, and share access. Responses were also gathered about the suitability of using digital posters in collaborative learning spaces and the potential for audience interactions.

Table 1: Student survey results

Survey question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. A digital poster is easy for students to create.	18%	50%	18%	14%	0%
2. A digital poster allows students to include relevant content.	32%	60%	8%	0%	0%
3. A digital poster allows students to be creative.	38%	44%	10%	8%	0%
4. A digital poster suits students learning in a collaborative learning space.	38%	48%	14%	0%	0%
5. A digital poster is easy for students to share within a team, with academic staff and with peers.	48%	44%	6%	2%	0%
6. A digital poster allows the audience to interact with the poster.	42%	44%	10%	2%	0%

As illustrated in Table 1, the most positive responses were for: 2. relevancy of content; 4. suitability of space; 5. sharing; and 6. audience interaction. Less positive results were for: 1. ease of use; and 3. creativity. This was reflected in the responses to these two open questions:

- *What do you think are the one or two main benefits of students creating a digital poster?*
  A thematic analysis revealed the benefits were: ease of collaboration (54%); ease of communication and interaction with audience (26%); and creativity (20%). Other benefits noted were that teams did not have to meet face-to-face to complete the poster, it was interactive and engaging, it encouraged teamwork, it was possible to edit and tweak on an ongoing basis (which could not happen with a printed poster), and students felt they were using the latest software to do real tasks.
- *What do you think are the one or two main challenges of creating a digital poster?*
  A thematic analysis revealed the challenges were: technical issues (62%), such as not knowing how to use Google Sites and not being aware of its limitations regarding layout and positioning of content; creativity (26%), where students were unsure how best to produce a visually attractive design; and difficulty with collaboration (12%), especially since only one person could edit a page at one time. Other challenges noted were being able to edit images, creating concise content, maintaining group consensus and understanding the assessment requirements clearly.

Academic staff responded that the digital posters approach suits inquiry-based learning, allows for creativity and the investigation of questions in more depth compared with printed posters, provides a flexible learning option and allows for multiple types of media. Some challenges noted were that students and staff need time to learn how to use the technology (but did not state if time was lacking), there might be too much scope for creativity, and there could be too much focus on the presentation of the poster instead of its content (which can also occur for a printed poster).

The content items in the 12 student Google Sites posters were quantified as being either static or dynamic. As shown in Table 2 below, the use of static items was similar in all groups with a title, headings, text, graphical elements (such as photos, diagrams, graphs/charts and maps) being included in most posters. The greatest variation occurred with the use of dynamic items, with active links most commonly included in a poster, as well as external YouTube videos. With the exception of one poster, all had additional pages to provide reference details and some included navigation and search features. Two posters embedded a Google Drive presentation (created by the team) and a Prezi (sourced externally by the team). This might suggest that academic staff need to indicate to students what kinds of static and dynamic content would be appropriate.

Table 2: A comparison of static and dynamic content items

Static content	*No. of posters*	Dynamic content	*No. of posters*
Title	12	Active links for references	7
Author names	4	YouTube video embedded (external video)	7
Headings	10	Links to YouTube video (external video)	1
Text	12	Prezi embedded (not created by team)	1
Photo	12	Google Slides embedded (created by team)	1
Diagram	7	Number of sub-pages (links to these pages provided in navigation and/or content)	*0 page = 1* *1 page = 3* *3 pages = 2* *5 pages = 5* *7 pages = 1*
Graph/chart	11	Left navigation menu (on home page)	3
Table (information/results)	6	Top navigation menu (on home page)	2
Image of map	5	Search tool	5
Reference list on home page	2	Google map	0
Reference list on sub-page	11		

Conclusions

The digital posters approach seems to have been challenging for some students, but overall it was one that effectively engaged most students. The academic staff commented that students were very motivated and positive during the final poster presentation session in the collaborative learning space. Interestingly, staff did not realise that some students found the task difficult, and this suggests that perhaps the initial challenges were daunting, however most students eventually seemed satisfied and confident with the final outcome. Two academics stated that using a digital poster challenges the notion of what a scientific poster could or should look like and that this trend needs to be followed and further developed at QUT. This therefore means that academic teams need to be clear about the assessment instructions and guidelines provided to students, as well as be mindful of the support and direction that might be required during the semester. This is especially pertinent since the types of digital posters can be quite varied including:

> *lecture-capture lectures, videos, slideshows, short games, audio files, and "mash-ups" of various types of digital content. Anything that may be created as a web-deliverable multimedia file or a web-page may be a made into a stand-alone digital poster session* (Hai-Jew, 2012, p. 268).

Finally, two broader trends are worthy of continued investigation regarding the appropriateness of digital posters. The first is how digital learning can contribute to deeper learning through personalised skill building via the tools used for production, collaboration and simulation, and due to the enhanced access to learning (VanderArk & Schneider, 2012). The second is by being aware of what first year students expect at university and the skills and knowledge they bring to their learning environment—for example, students may be seeking flexibility, interactivity, relevancy, ways to measure progress, challenging but achievable tasks, and opportunities to develop some expertise in an area of interest (NGLC & iNACOL, 2013).

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Enhancing learning analytics by understanding the needs of teachers

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The field of learning analytics has great potential to inform and enhance teaching and learning practices in higher education. However, while many studies are being conducted to examine new learning analytics tools or ways that learning analytics can be used to address specific problems such as student retention, few studies have explored the fundamental needs of teaching staff in addressing educational problems or making improvements to their teaching. This paper presents the initial findings from research being conducted with staff associated with teaching and learning at the University of Melbourne to identify the needs and potential uses of learning analytics to improve educational outcomes. The role learning analytics will play in informing teaching practice in higher education is considered, as well as implications for future research in the field.

Keywords: Learning Analytics, Higher Education

Introduction

Research in the field of learning analytics in higher education has developed rapidly over the past few years. The increasing availability of large data sets from university learning systems offers great potential for data interrogation with the goal of informing and enhancing teaching and learning practices and environments. However, without a clear understanding of academic needs, learning analytics tools risk missing the mark or falling short of their potential. At the University of Melbourne, a working group has been established to investigate the issues related to the use of learning analytics in higher education contexts and the potential role for analytics at the University. This paper presents the initial findings from a research project undertaken by this group, a work in progress, investigating staff needs and potential uses of learning analytics. The paper outlines the preliminary themes that have emerged from focus groups held with staff associated with teaching and learning across the University. It considers ways that learning analytics could be used to assist teachers to address the educational problems they commonly face with students, particularly in digital environments. It also considers the implications of the findings on the future direction of research in the field.

Learning analytics provide an opportunity to improve educational outcomes through the analysis of data about learners and their activities. The focus of learning analytics is on the learning process at the personal, course or departmental level (Long & Siemens, 2011). However, a 2012 study of analytics in 336 higher education institutions found that, despite the existence of large amounts of data, the current use of this data is almost exclusively for credentialing and to meet reporting requirements, rather than to inform teaching and learning practice (Bichsel, 2012). Research in learning analytics to date has tended to focus on issues such as student retention or single tool or problem scenarios (Kennedy et al., 2012). Therefore more research is needed to examine the fundamental issues that can make analytics useful to teaching and learning practices (Lockyer & Dawson, 2012).

While most studies have a particular tool or problem in mind that drives the use of learning analytics, the project reported on in this paper seeks to gain an insight into the various needs of teaching staff in addressing educational problems or making improvements to their teaching. The findings will drive decision-making with respect to the possible implementation of learning analytics at the University. While the research project is of direct importance and relevance to the University of Melbourne, it also contributes to a more fundamental understanding of issues associated with learning analytics, an emerging field which is currently under-researched
.

Method

The research is guided by three main questions:

1. What are the key teaching and learning problems/situations that teachers face for which learning analytics could be useful?
2. What data could be used to address these educational problems/situations?
3. What actions can teachers take in relation to the identified educational problems/situations?

A series of focus groups were held with staff associated with teaching and learning across the University. While nine focus groups were held, this paper reports on the data from the first seven groups, which had been completed at the time of writing. The complete sample was chosen to be representative of teaching and learning practice at the University across discipline and degree levels, with six focus groups comprising staff involved in the delivery of each of the six new generation degrees, and three focus groups with staff from the law, engineering and education graduate schools. Participants for the focus groups were nominated by the Associate Dean (Teaching and Learning) and/or program coordinators across the faculties and graduate schools. The seven focus groups reported on in this paper comprised a total of 29 staff.

Participants were initially asked to describe their teaching practices and then they way in which they used technology to support their teaching, in order to identify potential sources of data about learners. The remainder of the focus group was structured around the three main research questions. As participants sometimes had limited familiarity with learning analytics, examples of existing learning analytics reports and dashboards were used as prompts for focus group discussions. This stimulated comments about ways in which existing and new types of analytics could be used to address teaching and learning problems. A thematic analysis of the data was then conducted to identify key themes in participants' responses.

Results and Discussion

The educational problems/situations and potential ideas for the use of learning analytics that were identified by academic staff in the focus groups were many and varied. They fell into five broad categories: (1) student performance, (2) student engagement, (3) the learning experience, (4) quality of teaching and the curriculum, and (5) administrative functions associated with teaching. Other themes that emerged from the analysis included discipline differences in educational problems and analytics needs, the utility of currently available data representations, and the differences in teachers' perceptions about the usefulness of learning analytics in comparison with the literature in the field. Each of these categories and themes will be considered in greater detail.

Optimising student performance and engagement was the most common potential use of learning analytics identified by staff from across the disciplines. The associated educational problems identified included identifying 'at risk' students, attendance in lectures, student access to learning resources, performance in assessment, and providing feedback to large classes. The majority of participants wanted access to data showing the correlation between student engagement (as measured by attendance in lectures/tutorials), students' access to online resources, students' participation in online communication, and their performance in assessments. It was thought that it would be beneficial to student learning and motivation to be able to provide either individual or cohort feedback on the relationship between student engagement and performance levels.

Important issues that arose in relation to the use of learning analytics to provide students with feedback concerned the way in which the feedback was to be presented and the ability of students to interpret such feedback. Some indicated a preference for being able to provide general feedback to cohorts of students that outlined the profile of high performing students from previous offerings of the subject. Others suggested that individual feedback should be provided directly to students:

> The self-diagnosis thing I think would be an interesting thing to explore. To actually give the students a bit of power over the sorts of information they have about their own approaches to study. And maybe with time it would build up a bit of a data bank or knowledge about the particular discipline areas or subjects. In general this seems to be the sorts of patterns for those students who've done well and how do you map against those patterns. Something like that would be really really powerful for students. (Business academic)

The idea of being able to profile an 'ideal student', or to allow students to compare their engagement and performance with the rest of the class, was seen as important to making the feedback useful for students. However there are also challenges associated with offering a standard picture of high performance. For example, an academic from Engineering commented that:

> The grades and assessments speak for itself… it's good to have a high grade, it's bad to have a low grade – but when you come to communication and activity it's not so clear anymore. You could be a brilliant student, way ahead of the class, but you have not been accessing the discussion board … is that bad?

This highlights an area of learning analytics that requires further exploration; specifically how feedback from learning analytics can be given to students in a format that is most beneficial to their learning, as well as how students can determine the actions they need to take in response to such feedback.

Several academics saw the potential of using learning analytics to improve understanding and adaption of students' learning experiences. This was seen as an extension to understanding student engagement and performance towards developing a greater understanding of how students develop knowledge, with the potential to distinguish between strategic and deep approaches to learning (Biggs, 1999). An academic in Business suggested that being able to track knowledge development from prior knowledge through to understanding demonstrated at the end of the subject could be one way to determine the value of particular educational approaches. However, participants also acknowledged that there isn't always access to the necessary data to facilitate this kind of analysis. Caution has been recommended when using learning analytics for the measurement of learning quality so that reductionist approaches are avoided (Lodge & Lewis, 2012).

Another category of potential use of learning analytics was the enhancement of quality of teaching and the curriculum. In Law it was suggested that an automated textual analysis of messages sent to online tutors could be used to identify common issues students were facing so that these issues could be addressed with the whole class in face-to-face sessions. Similarly, in Arts it was suggested that analyses of discussion forum posts or the identification of support resources that had a high level of student access may help in detecting areas where students are struggling. Other disciplines saw value in deeper analysis of assessment results, especially formative and summative assessments held early in the semester, to identify aspects of the curriculum that may need further review.

Several groups identified the potential for learning analytics to be used to support administrative functions associated with teaching. Examples of these uses included: assessment of consistency between student placement locations (Education), enrolment and profiling of tutorial groups (Arts), tracking student safety compliance requirements for field trips (Engineering), and guidance for students on future subject selection (Arts). Participants noted that these were areas where existing data sets were available, but there was currently no way to access this data in a useful format. Participants also noted that the time saved by automating the analysis in these administrative areas could instead be devoted to curriculum improvement and student support.

Several participants indicated that they were either using or had attempted to use learning analytics to support their teaching, but had found their needs were not met by the data representations that were currently available. In particular, a number of participants felt that the reports that could be generated from the University's learning management system (LMS) were "not particularly useful". This was attributed to the fact that data wasn't sufficiently summarised in a format that academics could engage with quickly and easily. The ability to customise the format of reports was also requested. Representations of data from subject evaluations such as the centrally administered student experience surveys were said to be "practically useless because we can't have different views of them, like tutorial by tutorial breakdown in terms of responses" (Arts academic). The timing of the availability of such reports was also said to make the data less useful. It was also suggested that it "would be really good if… information could be presented in a visually accessible way" (Environments academic).

A common request that emerged across the focus groups was the ability to correlate data across systems. For example, combining data from the LMS or lecture capture system with student demographic and/or enrolment data from student information systems to provide greater context and meaning to the trends observed in the student activity data. As an example, a participant in Arts suggested:

> A lot of our students come from other faculties and we get a lot of science students in cinema studies in the first year as well. So it would be really great to be able to identify, at least the percentage of students, who are coming from other faculties who are coming to a very new culture of learning. (Arts academic)

Across the focus groups discipline differences were observed in terms of the educational problems presented and the potential uses for analytics proposed. For example, Engineering academics had a strong focus on the use of learning analytics to provide data to students on their own engagement and performance in the subject, putting the responsibility for the interpretation of the data and required actions on the students. Whereas academics from the Science, Law and Arts disciplines showed a preference for using analytics for subject evaluation and to give students more general feedback on the engagement habits and patterns of high achieving students. Discipline differences were also noted in relation to the availability of student data, with some disciplines making greater use of a wide range of elearning tools, whereas others reported limited use of such technologies. The learning designs and assessment activities used in different discipline contexts also has an impact on the types of data available for analysis.

To date, the literature on learning analytics has forecasted significant uptake of learning analytics in the higher education context (Johnson et al., 2013). However, it was evident across the focus groups that there remains a considerable amount of skepticism and confusion over the utility of learning analytics. The majority of participants in the focus groups admitted to not being fully aware of the definition of learning analytics prior to the start of the session. When examples of existing learning analytics reports and dashboards were used as prompts in the focus groups few participants felt the reports were presented in a format that would be useful in their context. Instead, participants offered suggestions of how similar ideas could be used with different data. This indicates that there is a potential disconnect between the reports and dashboards emerging in the learning analytics field, and the needs of academics associated with learning and teaching in the classroom and online. Participants also raised concerns about the level of skill and time required to adequately engage with learning analytics in a useful way. It has been suggested in the literature that effective adoption of learning analytics in higher education will be dependent on the ability of universities to build a culture of analytics (Norris et al., 2012). A central component in fostering this culture change is the professional development of staff, such that they have the expertise to analyse and interpret learning analytics data to inform educational decision-making (Wagner & Ice, 2012).

Conclusion

The data collected so far as part of this research project has provided important insights into academics' needs and attitudes towards the use of learning analytics in higher education. The potential uses of learning analytics, as identified by participants, go beyond student retention to identify aspects of learning processes and support strategies that can enhance learning engagement and performance. However, it seems as though a gap is evident between the focus of the learning analytics community and the academic voices profiled in this research. There is still work to be done to ensure academics see the benefits and opportunities that learning analytics can offer to improve teaching and learning processes and educational outcomes. Further research is needed to explore the specific ways in which learning analytics can provide useful and flexible outputs to teachers that can be used to both inform curriculum and assessment design, and support students' learning processes, outcomes and experiences.

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Prospects for iPad apps and learning design in medical education

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Educators are expected to keep up to date with the variety of new technologies that are available for teaching and learning. However, not all technologies will automatically increase a student's higher order thinking skills without the teacher carefully planning how the technology will fit into the educational context. It is through 'designing for learning' that a teacher conceptualises how emerging educational theories and practices can encourage students to take deep approaches to their learning. Tablet devices are increasingly being used in education, but using stand alone educational apps, which usually focus on a specific educational need, poses a potential limitation to good learning design based on scaffolding of multiple activities. This paper explores a theoretical model of how a learning design system (such as the Learning Activity Management System – LAMS) can be used to create app-based learning designs, specifically in a medical context.

Keywords: iPad, educational apps, learning design, LAMS, medical education, mobile learning

Introduction

Research into the use of technology in teaching has matured rapidly as educators have striven to provide high quality, research-validated tools that enhance learning. Charlton (Charlton, Magoulas, & Laurillard, 2012) summarises the choices that many of today's educators face, regardless of their confidence in the use of technology in teaching:

> …a variety of tools and technologies are available and teachers are expected to use technology-enhanced learning, to know when, how and what tools to apply, and to understand the impact of taking on such a challenge.

Students expect greater amounts of flexibility with their learning (Ellis & Goodyear, 2010), however educators still remain concerned that "many learners lack general critical skills and research skills: 'digital scholarship' is poorly communicated and modelled in many subject contexts." (Beetham, McGill, & Littlejohn, 2009). Thus, educators are pressured to provide a course with high quality technology for students to access learning when they want it and how they want it (Jefferies & Hyde, 2010), while they are still unsure that these tools are the best ways to provide teaching that is authentic and promotes high order thinking skills (Oldfield & Herrington, 2012).

Designing for learning

Laurillard (D Laurillard, 2012) argues that teaching is much more than the transmission of knowledge from teacher to student. The educationist need to be involved in scaffolding the students learning; embracing, not rejecting technology and helping learners develop the new skills they will need to be digitally literate. Educators who embrace technology must not fall into the trap that students can do it all for themselves just because there is such wide access to information through the web.

Laurillard further argues that teaching should be considered a design science, like engineering or architecture. Arguing the need of good design skills in teaching is not a new idea, for example Boud and Prosser (Boud & Prosser, 2002) were commissioned to investigate principles for high quality learning in higher education. They argued that a good learning design should: engage learners, acknowledge the learning context, challenge the learners and provide practice.

The field of Learning Design focuses on finding systematic ways to conceptualise what good teaching and learning looks like, and to show designs that embrace emerging theories and models of how to best facilitate effective learning. This recognised need for good modeling of learning design has led to renewed interest in how good learning designs can be communicated to teachers and to also focus on how technology can be used to promote different pedagogical approaches (Diana Laurillard et al., 2013).

From a healthcare education perspective the idea of using good learning designs is particularly attractive, where a large proportion of teaching is performed by clinicians. Although they are an excellent source of highly specialised knowledge and can demonstrate the procedural skills needed in medicine, they rarely have formal training in teaching and are usually ignorant of the full range of research about teaching and learning. It is therefore important that educationalists can provide a solid framework for learning (or a learning design) to the content expert so that they can be guided pedagogically while providing their valuable content knowledge.

It was with this thinking that the School of Medicine at the University of Western Sydney (UWS) created a series of fairly loose but carefully planned templates for content experts to use when creating a series of online modules that explore the scientific basis of medicine (B. Dalziel, Mason, & Dalziel, 2009). These modules are used by the students while they are participating in clinical rotations where they do not have access to lecture style teaching. The modules are still being used successfully four years later by students, with several iterations of the project making improvements and implementing lessons learned about the value of different learning designs (J. Dalziel & Dalziel, 2010, 2012).

How could the iPad fit into learning design theory?

In 2013, UWS initiated a wide reaching, blended learning project by giving an iPad to each student starting a first year unit at the university. This was accompanied by an increase in staff training and opportunities to learn about the educational affordances of the iPad through training sessions and online workshops.

UWS has understandably placed some pressure on staff to embrace this opportunity to use the iPad in their teaching, which is simultaneously exciting and overwhelming. There has been a huge increase in courses offered for staff to learn about different education and presentation apps (e.g. Prezi, NearPod, Blackboard and Collaborate mobile apps) with a significant demand on staff to consider all the ways that students can learn using these technologies. Some lecturers have turned away from the device, but "education must now begin to drive its use of technology" as these technologies are "increasingly impacting on work, leisure and learning" (D Laurillard, 2012).

So then, how does the use of educational apps on iPads or indeed, apps on other tablet devices fit into the conceptual framework of learning design theory? By their very nature, most apps are standalone technologies that are designed to solve one specific educational need. For example, an anatomy app might identify the bones in the skeletal system using an interactive visual approach to demonstrate these anatomy concepts (Figure 1). Another app might allow students to play a 'gene-mixing' game to understand the concepts of genetic dominance.

Figure 1: Sample Anatomy and Physiology apps featured in Apple iTunes store (28/06/2013)

But these apps don't usually take the concepts to the next level of deeper learning, or allow the teacher to edit the content or embed the app within the framework of a learning design. This new leap into educational technology could be argued to be a leap backwards for the pedagogical needs of good learning design where the technologies should be scaffolded within a larger framework of activities. While this could be done artificially with students being given instructions by the teacher on how to use the apps and then returning to the classroom for some face to face discussion, this seems clumsy in comparison to work on streamlining education activities all within the one system (such as in a Moodle course page or a LAMS sequence).

Theoretical description of how LAMS can create an app based learning design

The theory and literature discussed above in relation to learning design and the introduction of educational apps offers a theoretical framework in which to investigate how a learning design technology (such as LAMS) could be used to link together a series of educational activities (including apps launched from iTunes or Google Play stores, or already on the tablet device) to create pedagogically sound, scaffolded learning designs that can be embraced by medical educators at UWS and adapted for use by other disciplines.

At the heart of an app-based learning design approach is the idea that several apps can be used in a particular sequence in order to achieve a broader educational outcome than would be possible with a single app. Careful arrangement of apps in a sequence (including relevant content within each app) can achieve more than stand-alone apps, for example, a sequence could begin with an anatomy visualisation app, followed by a differential diagnosis app (drawing on the anatomy knowledge) followed by an app which simulates a busy hospital emergency room in which solving a patient case involves synthesising the anatomy knowledge with the differential diagnosis approach in a time-constrained scenario.

From the perspective of learning design, the goal here is to not only to combine these individual apps into a sequence that achieves deeper learning outcomes than would be possible with stand-alone apps; but also to provide a template which could re-use this structure for other topics – for example, the same structure could be re-used with a heart physiology visualisation app, followed by the differential diagnosis app applied to heart problems, and then these would be applied in the emergency room app with a different patient case based on a heart attack scenario that requires decisions within a limited time period.

The approach described above is effectively using the learning design software as a sequencing engine for apps – and provided that the apps can be invoked by this engine (such as via URL-like calls to installed apps or apps in the iTunes or Google Play store), then there is the potential to achieve a hybrid of learning design and app technology. In addition, using a learning design system like LAMS for this approach would allow for traditional web-based activities (such as forums, quiz, wiki, etc) to be used as well as apps. This approach may be useful where it is difficult to find an appropriate app for a particular purpose, but where a web-based tool is available for an equivalent educational purpose.

Initial technical trials have indicated the potential for LAMS to act as an app sequencing engine where apps can be invoked using URL-like calls. Nanyang Techological University, Singapore is using LAMS to launch apps to facilitate a team-based learning (TBL) approach to teaching in medicine (Gagnon, 2013). It may even be possible in the future to send information to these tools via these calls, such as parameters for app self-configuration according to the educational goals of the sequence. And where the apps are not restricted to a particular organisational context (ie, the apps could be accessed by educators and students in other organisations), then there is the potential to share LAMS sequences that incorporate apps in the sequence structure. This would allow for community sharing of good practice in the development of app-based learning designs

An iterative process of developing and improving the concepts as outlined above, that is, a design-based research approach (Reeves, McKenney, & Herrington, 2011) will be used in student trials in 2013 and 2014. A variety of app integration models will be explored technically (including the potential for sending parameters to apps), as well as development of different pedagogical strategies (such as Predict – Observe – Explain; Problem-Based Learning, etc) and how different apps can be used both for different medical content and for different strategies.

Conclusion

There is considerable promise in the idea of combining learning design with educational apps. It has the potential to address the growing educational challenge arising from the limits of stand-alone apps, while still using individual apps for their specific benefits. By combining various apps into a scaffolded sequence of learning activities, there is greater potential for achieving deeper approaches to learning among students. In addition, the potential for sharing app-based learning designs through learning design repositories (such as the LAMS Community) offers the potential for sharing good practice in the use of apps in medical education and, potentially, for other disciplines.

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Implementing Learning Design: A Decade of Lessons Learned

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This paper offers reflections on developments in the field of Learning Design from 2003-2013. It considers evolving conceptual issues, technology developments and communities of practice, and concludes with reflections on the future. Areas considered include: the conceptual challenge of aligning the pedagogical metamodel of Learning Design with principles for effective teaching and learning; the impact of the wider educational landscape on Learning Design, particularly developments in Curriculum Design; whether learning really can be “designed”; technology developments and challenges, and sharing among different kinds of Learning Design communities. The paper draws on past and current research in Learning Design, particularly the recent Larnaca Declaration on Learning Design.

Keywords: Learning Design, e-learning, Curriculum Design, sharing, LAMS, Pedagogic Planners, open educational resources

Background

At the 2003 ASCILITE conference, the paper “Implementing Learning Design: The Learning Activity Management System (LAMS)” (Dalziel, 2003) provided a brief overview of the new field of Learning Design, and discussed the development of a Learning Design system (LAMS), and this paper has subsequently become the main paper cited about LAMS (316 citations in Google Scholar as at June 2013). In the decade since this paper, the field of Learning Design has evolved in terms of its conceptual frameworks, its technologies, and its communities of practice, and LAMS and associated work has contributed to this evolution. Given the “Learning from the Past, Understanding our Present and Imagining the Future” themes of ASCILITE 2013, this paper reflects on a decade of developments in the wider field of Learning Design, including reflections on the contributions of LAMS. This paper does not seek to be a comprehensive review of developments in the field of Learning Design or the LAMS software, but rather a review of key themes over the past decade from the perspective of the author. One goal of this paper is to reflect on issues that have been actively discussed in conferences, workshops and other “ephemeral” communications that have not always received equivalent discussion in the written literature.

Before discussing developments in the field, an overview of Learning Design and the 2003 paper will provide a basis for further reflections. While there are many definitions of Learning Design (see Dobozy, 2013 for a review), and issues with the definition of the field are relevant to the reflections offered below, Learning Design can initially be described as the creation, sharing and implementation of sequences of teaching and learning activities that include both content and collaboration. The field covers ways of representing these sequences, communities for sharing them, and software for implementation of learning designs with students, covering both online and face to face contexts. It is important to note that “sequences” should be interpreted broadly to mean any set of activities for students that take place over time, rather than only simple linear sequences of activities. Learning Design also includes principles and processes for advising educators on designing effective teaching and learning experiences for students.

At the time of the 2003 paper, the new field of Learning Design was in part a reaction against other "content centric" views of e-learning (eg, "Learning Objects") that often only catered for single-learner online experiences. Since this time, collaborative learning has become a major trend in e-learning through the wider use of collaborative learning tools (especially in Learning Management Systems – LMSs), and the rise of social media and Web 2.0 approaches. Hence, the original "quarrel" between Learning Design and courseware styles of e-learning looks quite different a decade later – although perhaps not primarily due to the impact of Learning Design itself.

In terms of LAMS, the software has continued to evolve over the past decade, including its release as open source software in 2005, and a complete development of the software architecture in 2006-2007 (LAMS Version 2). Among the new features made possible by this redevelopment was the potential for different languages, and there are now 33 different translations of LAMS maintained by a community of over 110 translators. As at the 30th of April 2013, the LAMS Community website had 8,726 members and a repository of 1,584 freely shared LAMS learning designs which had been downloaded/previewed over 50,000 times (Dalziel, 2013). The LAMS software has incorporated new activity tools, features and refinements, but is still fundamentally similar to the description given in the 2003 article, including the importance of the visual authoring environment – this is illustrated by the role play sequence shown in Figure 1, which includes use of the V2 "branching" feature (for further details on this role play, see Dalziel, 2010). Figure 1 is useful not just as an illustration of the LAMS software, but as an example of the focus on visualisation of teaching and learning activities ("a learning design") in the field of Learning Design (in this paper the capitalised phrase "Learning Design" refers to the field as a whole, while the uncapitalised phrase "a learning design" refers to a particular instance).

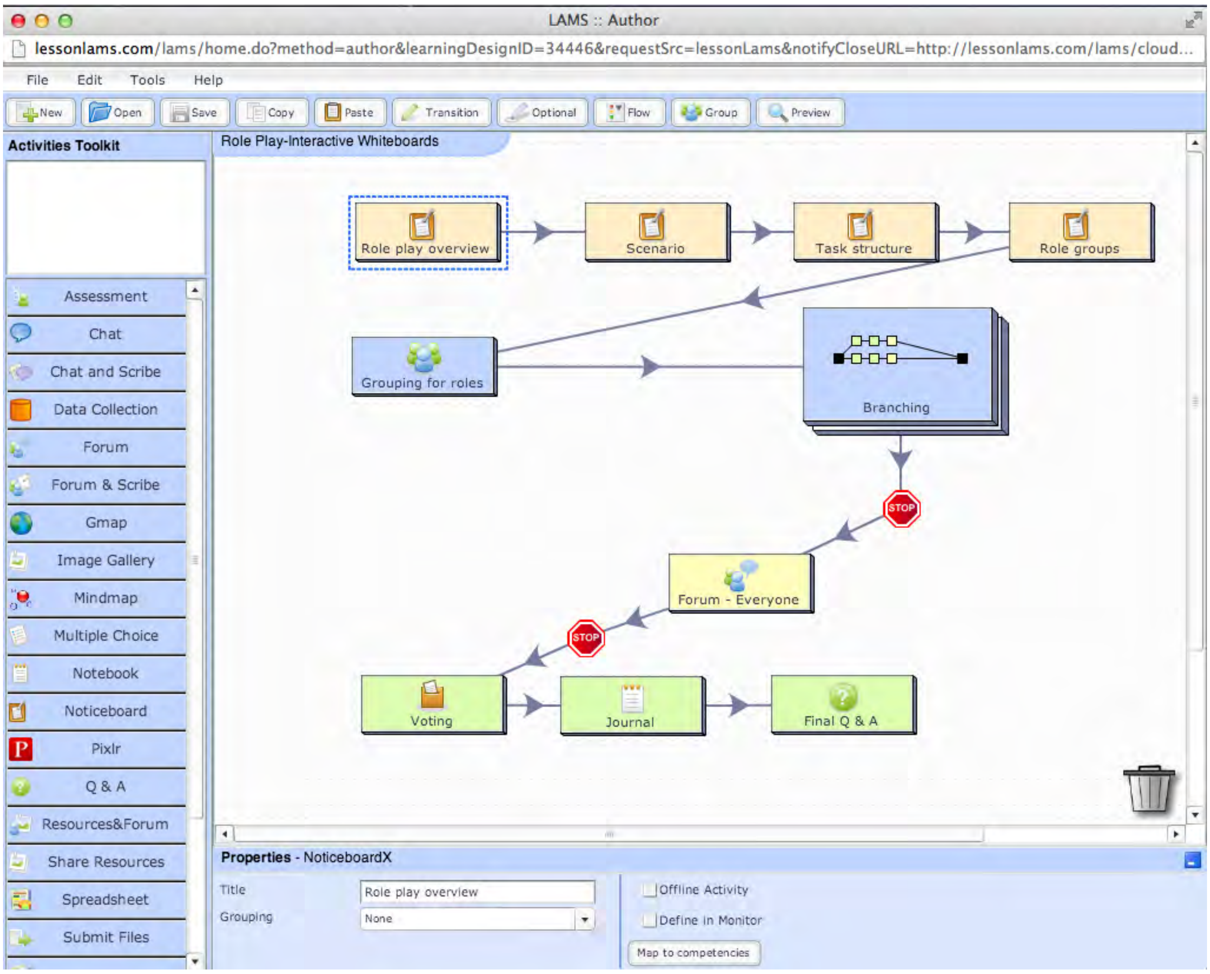

Figure 1: Example of role play sequence shown in LAMS V2.4 Authoring environment, illustrating a sequence of activity tools (taken from Toolkit on the left) and arranged into a format suitable for a role play based on two role groups ("pro" and "con").

This rest of this paper will examine three areas of past and current work in Learning Design: reflections on the evolving conceptual framework for Learning Design as a field of research (including four sub-topics); developments in technologies for Learning Design; and progress in sharing of learning designs, including online communities of practice and sharing of Learning Design research. The paper will conclude with reflections on future opportunities and challenges for Learning Design.

Conceptual Developments in Learning Design

While the phrase "learning design" has been used in various contexts for many years, the Larnaca Declaration on Learning Design (2012 – this document is discussed further below) notes that the field of Learning Design arose primarily from four parallel and partly connected bodies of research and development in the late 1990s and early 2000s – two in Europe and two in Australia:

- The foundational research on Educational Modeling Language (EML) by Rob Koper at the Open University of the Netherlands (Koper, 2001). The subsequent development of the IMS Learning Design technical specification (IMS GLC, 2003) relied heavily on EML, as well as Bill Olivier's research on e-learning specifications and the "Colloquia" software.
- The SoURCE project and related research in the UK (eg, Laurillard & McAndrew, 2002), led by researchers such as Diana Laurillard, Grainne Connole, Helen Beetham and many others.
- The Australian Universities Teaching Committee (AUTC) Learning Design project, based at Wollongong University (see http://www.learningdesigns.uow.edu.au/)
- The development and implementation of LAMS (see www.lamsfoundation.org) and the associated LAMS Community (see www.lamscommunity.org).

As the field evolved to incorporate a much wider range of researchers, projects and systems (eg, see the "Timeline" from the Larnaca Declaration for examples), there have been different streams of thought and emphases within the field of Learning Design over the past decade. One cluster has focused on creating a technical language for describing teaching and learning activities and implementing these descriptions in software, while another cluster has placed greater relative emphasis on describing and sharing effective pedagogical methods. It is interesting to note that both of these streams of thought about Learning Design were present in the four early projects, but with considerable differences in emphasis – EML, IMS LD and LAMS focused more on the technical side, whereas SoURCE (and subsequent UK projects) and AUTC Learning Design focused more on sharing effective pedagogical methods.

As the field of Learning Design has a very broad focus (Larnaca Declaration, 2012), it is not surprising that different projects have investigated different subparts of the wider challenge. However, in the early years of Learning Design research, there was considerable debate among some researchers on the "right" perspective on Learning Design (eg, that IMS Learning Design was the only valid interpretation of the concept of Learning Design, see Britain, 2004), whereas with hindsight it appears analogous to the parable of the six blind men who touch different parts of an elephant, and so describe the elephant in different ways according to the part they touched (without recognising the whole elephant encompasses each description). One of the key developments in the field in recent years is that the "whole elephant of Learning Design" is becoming clearer. The following section reflects on four particular conceptual issues that have been debated over the past decade.

1. Pedagogical metamodel versus principles for effective teaching and learning

A challenging conceptual difference within the field arises from the concept of Learning Design as a descriptive framework for a "pedagogical metamodel" (Koper, 2001) which aspires to be "pedagogically neutral"; as compared with approaches which explicitly define principles for effective pedagogy as the basis for selecting and describing Learning Design (e,g AUTC Learning Design project – see Boud & Prosser, 2002). This issue has emerged in many ways across different Learning Design projects and research depending on the emphasis of the researchers. Is it more important to work towards a descriptive framework that can describe many different pedagogical approaches (but without any particular commitment to one approach); or is it more important to focus on principles that describe effective teaching and learning approaches (especially those that are student-centric) and to promulgate these widely to enhance education?

Following several years of debate among various Learning Design researchers, a group of experts worked together on this challenge (among others) in 2011 and 2012 leading to a new synthesis of ideas known as the "Larnaca Declaration on Learning Design" (Larnaca Declaration, 2012) – taking its name from the city of a significant meeting of this group. In the Larnaca Declaration, both dimensions of Learning Design are identified as important, but for different purposes. An analogy with music notation is used to explain the relationship between them – music notation provides an agreed descriptive framework for musicians to convey musical ideas to each other over time and space. In itself, musical notation aspires to be "neutral" about the music it conveys – beautiful music and mediocre music can be equally conveyed using the same descriptive framework. In this sense, the attempts at developing a descriptive framework for many different types of teaching and learning activities are analogous to the development of systems of music notation (be they Western music notation or other traditions). It is also worth noting that music notation does not capture everything about a musical performance – there is still an important role for interpretation – but it captures enough information to convey a musical idea from one person to another.

However, few musicians are interested in music notation purely for the abstract challenge of representing music on paper – they use music notation to try to convey beautiful music. And it is worth noting that the art and science of creating beautiful music (as opposed to mediocre music) is different from the structure of the representational system for writing down music. However, many composers benefit by studying the work of other musicians (conveyed via musical notation), so the two dimensions are not unrelated – they just focus on different aspects of the overall challenge.

In the Larnaca Declaration, the core challenge of a representational framework for educational activities is called the Learning Design Framework (LD-F) – which encompasses visualisation/representation as well as guidance for educators and sharing of designs; whereas the practical challenge of creating effective teaching and learning experiences for students is called Learning Design Practice (LD-P). While the Larnaca Declaration gives numerous examples of "early attempts" at representational frameworks for education (such as LAMS sequences, AUTC flow diagrams, educational patterns, etc) it recognises that education, as a field, has not yet developed any system of notation that has the expressive power or broad adoption of music notation.

Compared to a decade ago, there is now a better sense of how to synthesise these key ideas, and a path for developing more comprehensive and useful frameworks for describing teaching and learning activities. It is recognised that more than one framework may be needed, and that the goal of a grand, unified framework for educational activities may yet fail, but if it does fail, there is a hope that even the failure will offer valuable lessons about the potential, and limits, for describing and conveying educational ideas among educators (Larnaca Declaration 2012).

2. The wider educational landscape for Learning Design

A second challenging issue over the past decade has been the question of how and where to locate Learning Design analysis within the broader world of education practice. That is, most specific learning design examples tend to operate at a level of granularity of approximately one lesson's worth of activities, or around one week's worth of asynchronous online activities – with variations ranging from a few minutes for a very short learning design, up to several classes or weeks for longer learning designs). This level of analysis is quite different to the more traditional level of "course" or "curriculum" design, which typically describes the structure of content and activities over a longer period, such as a whole term or semester or year of work (depending on the educational context).

This recognition of different levels of granularity of design is only one small part of the wider educational landscape, there are many other issues that impact on Learning Design, such as educational philosophies, research methodologies and the characteristics of educational institutions, teachers and students. All of these factors affect the way that educators go about designing, teaching and reflecting on teaching experiences. This "teaching lifecycle" is the key point of contact with the core concepts of Learning Design, and the outcomes of this process can then be investigated from the student's point of view in the form of their responses to teaching, assessments, evaluations, etc. While there are many other issues that could also be considered, the Larnaca Declaration offers a synthesis of this wider landscape and its relationship to core Learning Design concepts in the "Learning Design Conceptual Map" (LD-CM) – provided in Figure 2. While this is a relatively new addition to the field, it is hoped that it might provide a lens for organising discussion of wider factors that impinge on Learning Design Practice. The Larnaca Declaration concludes with a simple summary of how the three elements of Learning Design Frameworks, Learning Design Practice and the Learning Design Conceptual Map make up the field as a whole – see Figure 3.

3. Can learning be designed?

A third challenging issue for the field arises from its very name "Learning Design" and whether it makes sense to talk about "designing" learning. There are two different aspects of this discussion. First, some researchers in workshop discussions have wondered whether the field would be better called "Teaching Design", as so much of the focus is on how educators make decisions about structuring activities for learners. This issue has proved a two-edged sword: on the one hand, it is a reasonable observation to make about the focus of many practical aspects of the field; on the other hand, the kind of pedagogical approaches often associated with Learning Design Practice are student-centric and opposed to excessive use of narrow "instructivist" modes of education, and so the emphasis on the word "Learning" in the title of the field, rather than "Teaching" is seen as an important signifier of the broader pedagogical leanings of those parts of the field that address principles of effective learning.

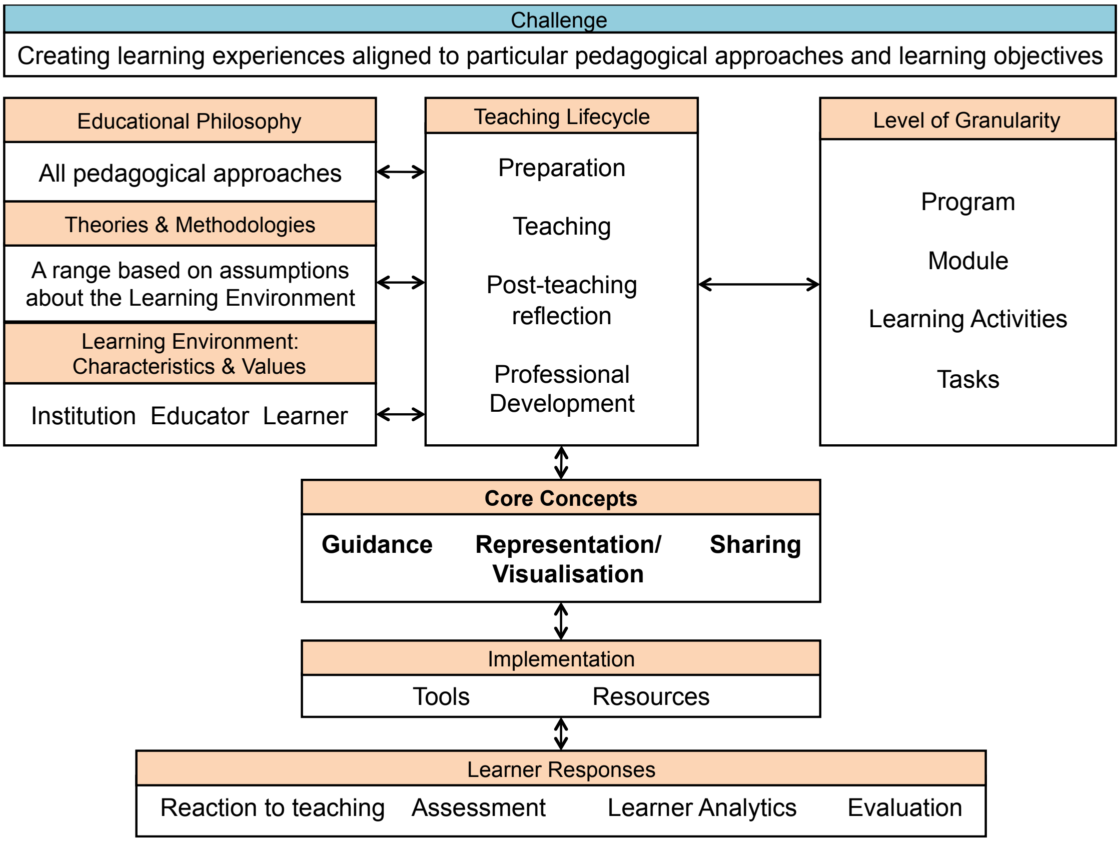

Figure 2: The Learning Design Conceptual Map (LD-CM) from the Larnaca Declaration, illustrating connections between core Learning Design concepts (middle) and teacher planning activities (above) and implementation activities (below)

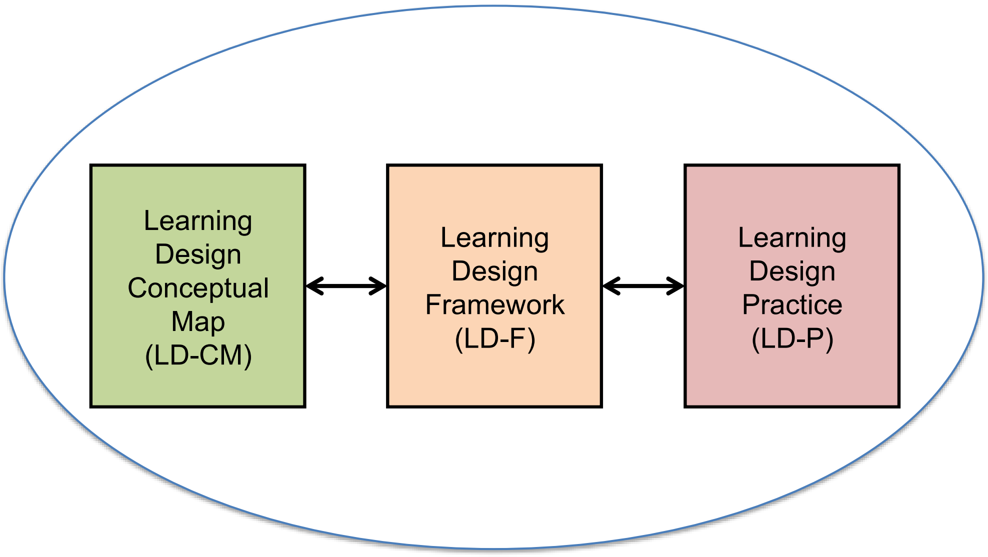

Figure 3: The components of the field of Learning Design as presented in the Larnaca Declaration

It will be interesting to see how the future views this issue – there may come a time where educators can talk about the design of teaching activities that have a strong student-centric focus without feeling the need to resile from a phrase like "Teaching Design" – but the author's experience is that this is yet to occur, so the name "Learning Design" continues to contain an important embedded signifier of certain pedagogical leanings within much of the field.

A second complex conceptual issue lies beneath this terminological debate. In recent years Peter Goodyear as been at pains to point out that learning is the internal experience of students, and so it doesn't really make sense for teachers to talk about designing learning, because this experience is out of their reach (eg, Goodyear & Retalis, 2010). All that a teacher can do is create a context in which certain types of learning might be encouraged, but actual learning is ultimately up to the response of the learner. Arising from this observation is a need to look more broadly at learning designs that are student-led and controlled, and to think about the role of educators in co-designing learning activities with students. This is an important critique of many current ideas in the field, and further research is needed to explore its implications in the future. This issue may yet prove to be a fundamental problem for the music notation analogy of Learning Design, as it asks the question of who is the "performer" of educational notation – the teacher or the student?

4. From Learning Design to Curriculum Design

A final conceptual issue to note from the past decade has been a shift of emphasis from "small scale" Learning Design (ie, a class or a week) to wider Curriculum Design issues (ie, a whole unit or course). As the relative emphasis given to technical issues in Learning Design began to subside after the early years of the decade (for further discussion, see below), there was an increasing recognition in the field that decisions made at the level of a single learning design were often powerfully affected by wider course design issues, and so both the Learning Design and Curriculum Design "levels of granularity" need to be considered together. This broadening of focus was most obvious in the UK, where a major JISC funding program on Learning Design (http://www.jisc.ac.uk/whatwedo/programmes/elearningpedagogy/designlearn.aspx) was followed by a major funding program on Curriculum Design – largely as a result of feedback on the earlier project (http://www.jisc.ac.uk/whatwedo/programmes/elearning/curriculumdesign.aspx).

Part of the earlier JISC program was support for the development of two "Pedagogic Planners" – Phoebe

(Masterman & Manton, 2011) and the London Planner – and this research was subsequently extended by a major research grant to Diana Laurillard and colleagues (Laurillard et al, 2013) for the "Learning Design Support Environment" (see https://sites.google.com/a/lkl.ac.uk/ldse/) – later renamed the "Learning Designer". These projects, and similar LAMS research ("LAMS Activity Planner" – see the Templates area of www.lessonlams.com) examined ways to provide advice and guidance to educators on creating, choosing and/or editing learning designs to support curriculum goals. At the current time, the Learning Designer has the broadest focus, with guidance for design at both Curriculum Design and Learning Design levels, and it will be a key project to observe into the future in terms of potential further development and practical experiences from uptake by educators.

Technical Developments in Learning Design

While the core concepts of Learning Design can be applied in face to face educational settings without the use of computers, the origins of Learning Design had a strong technical focus. The emergence of Educational Modeling Language, and its subsequent adaptation for the IMS Learning Design specification, was for many early (technical) researchers the "essence" of Learning Design. Related to this was the attempt of the "Valkenburg group" to collaboratively develop a software system based on these ideas (Koper & Tattersall, 2005).

In practice, Learning Design software has proved much more challenging to develop than most researchers anticipated. The field has seen a significant number of prototype systems, but few have moved beyond this stage of development to wider use. From an IMS LD perspective, the main effort was the "Coppercore" engine (see www.coppercore.org), complemented by the ReLoad authoring environment, and the incorporation of activity tools via software such as the SLeD player. Other approaches adapted existing e-learning systems to some or all of the requirements of IMS LD (eg, Grail; MOT+).

One of the core challenges for development and implementation arose from the complexity of the underlying model of IMS LD – in particular, its requirements for (separately) describing roles, activities and environments for each step in a sequence. For educators, it was difficult to apply these concepts to typical teaching contexts without considerable prior training in the complex structure of IMS LD; for software developers, it required a very high degree of flexibility across many different interconnected software components, and this proved challenging to unify into a stable and ease to use system.

Part of the reason for the adoption of LAMS by educators was its alternative approach to these challenges. The development of LAMS was based on a deliberate simplification of the concepts behind the IMS LD model – the focus was primarily on two roles (teacher and student) that were "hardwired" into the overall system architecture (although some student sub-roles did exist, such as the discussant and recorder roles in the "Chat & Scribe" tool). Authoring was based on the sequencing of activity tools (ie, forum, chat, quiz, etc) where these tools represented a "pre-configured" combination of the activity and environment components of the IMS LD model. These tools had their own internal settings (eg, students answers to the "Q&A" tool could be anonymous or named); but the pre-configured activity tool provided a limit on the amount of flexibility contained within each tool.

This limit to flexibility helped software development (by constraining the size of the overall development challenge) and also helped educator understanding (by dividing up the features of the software into tool-sized "chunks"). Combined with a visual, drag and drop authoring environment, this approach proved more easily understood and adopted by educators (although not without a steep learning curve of its own – Masterman & Lee, 2005). Other more recent Learning Design software development has followed a similar "tool chunking" approach (eg, the METIS project).

Looking back after a decade, one of the technology surprises is that Learning Design functionality has not been integrated into the core of Learning Management Systems. While there are integrations of Learning Design systems with various LMSs that allow the two systems to work together, the core technical features of an authoring system and a "workflow engine" for managing the flow of students through a sequence of activities is yet to be added to LMSs. However, some "LD like" features have begun to appear in recent years, particularly the use of "conditional" activities, where a student must complete a certain activity in a LMS course area before the next activity is revealed (including potential requirements for progression such as achieving a minimum quiz score); and the related feature of "hiding" certain activities in a course area which are later revealed by the teacher according to a "LD like" plan of activities (NB: some LMSs have supported "hiding" throughout the past decade). One difficulty with these approaches is that the plan of activities is rarely extractable in a way that it could be easily shared with other educators (as implemented in learning design repositories in online communities of practice – see below).

There are various possible reasons for this lack of Learning Design functionality in LMSs to date. As noted above, the technical requirements for development are significant, and so the combination of only modest educator demand for Learning Design features coupled with heavy development requirements may have made this area "lower down the list of priorities" for some LMS developers. As a decision maker once said to the author "[Learning Design] is a pedagogical 'nice to have', but I doubt the people who pay our licensing fees will pay money for that".

A different explanation is that Learning Design is most useful when it incorporates relevant discipline content – "generic pedagogical templates" for Learning Design (eg, Dalziel, 2010) are theoretically interesting, but of little actual value to busy educators who need "ready to use" lessons – which means learning designs which incorporate discipline content. From this perspective, there may be significant opportunities for Learning Design to collaborate with textbook publishers in the future, given their very large collections of content, combined with pressures on their traditional print-based business model.

Looking back, the technical side of Learning Design has become relatively less of the overall field in recent years – not necessarily due to a decline in the amount of technical research, but certainly due to the relative explosion of less-technically oriented work on Learning Design such as sharing among educators (see below) and the provision of advice and guidance (as exemplified by the JISC Curriculum Design projects such as Viewpoints and OULDI – see Conole, 2013).

Despite various calls for changes to IMS LD since 2003 (eg, Dalziel, 2006), no changes have been made to the specification since its introduction, and it is the author's opinion that the relative importance given to technical interoperability of machine-readable learning designs has diminished as other areas of the field have flourished. However, it is possible that if Learning Design achieves wider adoption in the future, the technical interoperability questions may arise once again.

Learning Design Sharing and Communities of Practice

While conceptual and technical issues in Learning Design often provoke considerable debate (given their complexity), the concept of sharing remains a crucial part of the field – indeed, it can be argued to be one of the most important distinguishing elements of Learning Design (Conole, 2013). Drawing on the music notation analogy again, it is idea of conveying effective teaching and learning ideas from one educator to another (like sharing written music) that provides the motive force for the field. This sharing has typically been done using open education approaches, such as the use of Creative Commons licenses for shared sequences, and so learning designs can be seen as a type of open educational resource.

Some of the earliest online communities for Learning Design were focused on the technical challenges of development, particularly the "Unfold" community (Burgos & Griffiths, 2005). But parallel to the technically-oriented groups were other groups that gave relatively more emphasis to pedagogical issues, such as those facilitated by the CETIS Pedagogy and Education Content special interest groups. One of the early online communities for both technical and pedagogical discussions was the LAMS Community (www.lamscommunity.org), which provided an online community for technical discussion of the LAMS software, but also forums for educators and a repository for sharing of LAMS learning design sequences. Over time the repository has become the largest collection of community shared designs (1,584 as at April 2013) and the technical forums have remained active for discussion of LAMS development, but the educational forums have been more patchy in their discussions, with limited use in recent years.

A recent active online community for discussion of Learning Design among educators has been the "Cloudworks" site, which combines a Web 2.0 style of interface with features for fostering discussion and debate about Learning Design and related e-learning issues (Conole & Culver, 2010). In particular, Cloudworks has proved useful as a tool for collating materials and discussion for workshops and conferences – frequently in real time! Apart from the useful Web 2.0 features of Cloudworks, it has also had success in building and sustaining a community of educators (primarily in Europe) who use the site for ongoing discussion.

Looking to the future, one of the key challenges for Learning Design communities (and other e-learning communities) is how best to create and sustain an online environment that educators wish to contribute to on a regular basis. Despite the desirability of such a site, and some limited success in certain areas (such as

Cloudworks), it remains a wider challenge for the field of e-learning to build large, sustainable, active communities for discussion and sharing among educators. It seems that the main challenge here is not just the functionality and features of a site, but the community dynamics that lead to growing, active engagement. It is likely that differences in approaches to sharing between disciplines is a related factor.

Apart from online communities of practice, there have been a number of other contexts for sharing ideas and research about Learning Design. There have been a number of conferences and workshops, including several "pedagogic planner" meetings and CETIS DesignBashes (eg, see http://jiscdesignstudio.pbworks.com/w/page/45497380/CETIS%20Design%20Bash%202011), the 12 LAMS and Learning Design Conferences (7 in Australia, 4 in Europe and 1 in Asia – see www.lamfoundation.org/conferences), the various TENCompetence conferences (see http://tencompetence-project.bolton.ac.uk/), the AUTC Learning Design project conference (www.learningdesigns.uow.edu.au/ , the Learning Design Grid workshops (www.ld-grid.org/) and many other conferences, workshops and meetings.

There have also been a number of significant publications, such as "Learning Design: A Handbook on Modelling and Delivering Networked Education and Training" (Koper & Tattersall, 2005); "Rethinking Pedagogy" (Beetham & Sharpe, 2007 & 2013); "Handbook of Learning Design" (Lockyer, Bennett, Agostino & Harper, 2009); "Teaching as a Design Science" (Laurillard, 2012) and "Designing for Learning in an Open World" (Conole, 2013). There are also three edited volumes "LAMS and Learning Design" drawing on the LAMS and Learning Design conferences (Dalziel, Alexander& Kratjka, 2010; Alexander, Dalziel, Kratjka & Kiely, 2011; Alexander, Dalziel, Kratjka & Dobozy, 2013). There have also been a number of special journal editions on Learning Design, such as several special issues of the Journal of Interactive Media in Education (JIME) and Teaching English with Technology (TEwT).

Learning Design Futures

Looking ahead, there are many areas where the field of Learning Design may develop further. In the conceptual domain, it remains to be seen if the Larnaca Declaration will be broadly accepted as a foundation for future research and development, particularly its use of the music notation analogy and its arrangement of core concepts, and the three part categorisation of the field into Learning Design Frameworks, the Learning Design Conceptual Map and Learning Design Practice). The outstanding challenge of creating an expressive and widely adopted notational framework for teaching and learning activities remains for the future, although the examples offered in the Larnaca Declaration provide a glimpse of how this may evolve. However, the role of students as co-creators and managers of learning designs requires further investigation, especially in relation to informal learning contexts where the role of educator is minimal or absent.

One notable area for future conceptual development in the author's opinion is the idea of "pedagogic descriptors" of activities within learning designs. Both Laurillard (2012) and Conole (2013) have developed a small number of descriptors for activities (such as "Acquisition", "Discussion", "Inquiry", "Practice", "Production"), and by applying these descriptors to activities within a sequence (with potentially several descriptors needed for a single activity), it becomes possible to analyse a learing design sequence not just in terms of the activity tools used (eg, forum, chat, quiz, etc), but in terms of the pedagogical purpose of these activities. A promising attempt at mapping these descriptors to both Moodle and LAMS activities is given in Bower, Craft, Laurillard & Masterman (2011), and there is considerable potential to refine and expand this approach.

As the field of Learning Design continues to grow as a distinct area of research, it will useful to compare and contrast it with other related areas of study. There are valuable links to be made between Learning Design and other e-learning research with a strong focus on collaborative learning, such as Computer Supported Collaborative Learning (especially the connection between CSCL scripts and learning design sequences). In a similar way, the evolving research on educational patterns could be further connected with Learning Design ideas. There are already examples of cross-over research between these fields and Learning Design (eg, McAndrew, Goodyear & Dalziel, 2006), but a wider discussion between these fields is likely to be of mutual benefit – perhaps a joint conference of experts in these fields would be a useful next step.

Another major area of research that is yet to fully interact with Learning Design is Instructional Design. There are significant differences in philosophy and practice between these two areas, although there are areas of potential common ground. Based on some initial skirmishes in discussions online and at conferences, this interaction will be vigorous when it comes to full fruition, but both fields are likely to benefit from wisdom distilled from this discussion once the dust has settled. It is the author's view that in time, Learning Design will come to be seen as a superset of Instructional Design, but given the relatively broad, existing development of Instructional Design, and the less developed new field of Learning Design, this will take some time to judge.

While there are many incremental developments that can be made to Learning Design technologies, one significant development would be the rise of an "app" based Learning Design system – that is, a system that can sequence and co-ordinate a variety of educational apps. One of the pedagogical weaknesses of the explosion of interest in mobile devices and apps is a tendency to see apps as "silos" – that is, each app is used for a particular educational purpose, but without an easy way of linking together multiple apps to achieve broader educational goals. Learning Design has both the conceptual and technical foundations to assist with the development of "educational app sequencing" – so it will be interesting to observe how this possibility evolves.

Central to the future success of Learning Design will be its ability to harness the goodwill and efforts of both educational researchers and educators. While there are some promising examples of broad research collaboration (eg, between Learning Design researchers in Europe and Australia), and practical implementation (especially in some universities and schools), there is much more to be done to move Learning Design from a niche field to broader adoption. This will require a mixture of greater conceptual clarity, wider promotion of both theories and practice, mature technology and online communities, and a growing research base of lessons learned from implementation. While the field has made a promising start, there is much yet to do.

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Successful computer games and effective educational environments share many similar key attributes relating to instruction, goals, feedback and interaction. Unfortunately, many educators find it difficult to implement strategies in their curriculum to compete with the engagement of computer games. The recent surge in the popularity of *gamification* may hold the key and provide a framework by which teachers can implement simple strategies to increase engagement in their classrooms. To contribute to this domain about the affordances of gamification in education, this paper argues that the key attributes of engagement are the same whether they are in an education or game setting. It also extends a previous study that revealed a five dimensional model of gamified curriculum factors and examines each with respect to student engagement. The conclusion is the amount of engagement in the gamified classroom is dependent on the individual student's playfulness and acceptance of innovative and dynamic pedagogies.

Keywords: Gamification, Pedagogy, Games-Based Learning, Curriculum, Student Engagement.

Introduction

The fundamental core mechanics of games elicit immersion and engagement in participants in the same way as well-structured learning tasks. Games are engaging because they have the potential to satisfy basic psychological needs for competence, autonomy and relatedness (Przybylski, Rigby & Ryan, 2010). Instructional design has much to learn from engagement strategies employed in computer games (Dickey, 2003).

Soon after the personal computing revolution in the early 1970s, educators recognising the potential that technology and computer games had to engage, began the edutainment movement. Unfortunately, the premise for this crusade was fundamentally flawed with computer games being used as the sweetener for delivering educational content. Thus implying that games were fun, and education was not. This lead to the popular metaphor of edutainment likened to chocolate-dipped broccoli (Bruckman, 1999). Many of these games provided drill and practice exercises fitting with behaviourist learning theory and were little more than multiple-choice quizzes paired with fancy graphics and animated characters. Indeed, educational games (and now serious games) have grown-up a lot since and evolved into interactive learning platforms that consider a range of learning theories from constructivism to social-cultural and situated learning Egenfeldt-Nielson, 2005). However, with such a vast array of game genres and educational requirements it seems ludicrous that any one game type or application will meet all classroom needs and elicit the desired engagement and motivation educators are seeking. Yet, there are continued and prolific research efforts focussed on the use of specific games applied in isolated and small studies. The results of which do not contribute to knowledge in the domain as they cannot be reproduced or generalised.

Videogames themselves are not the solution to educational problems. However, when a curriculum is constructed with the properties of games in mind, learning may be improved (Gros, 2007). More recently, the gamification movement has assisted educators in articulating the exact characteristics of a games-based curriculum structure; however, the very idea extends much further back. In the early 1970s, points and reward systems were being employed in schools under the guise of the token economy (Kazdin & Bootzin, 1972). Like early edutainment, the token economy operated under a behaviouralist system with tokens being awarded to students for good behaviour in class that could later be exchanged for rewards. This practice still exists today (de Byl, 2013). Beyond this, the types of mechanisms employed in gamification have existed in one form or another in a variety of industries including: frequent flyer programs, loyalty reward cards and happy hours (Bell, 2010).

Beyond the obvious abhorrence of many in the computer games industry, and the criticisms of many associated academic's with the gamification movement (Bogost, 2011; Pavlus, 2010; Robertson, 2011), the fundamental principles of gamification - points, levels, rewards, leaderboards, quests and customisation - can guide instructional design. Educators, now more desperate to generate engaging and immersive learning experiences, are borrowing ideas and mechanics from games. In the past, teachers have focussed primarily on the application and development of specific games for classroom use, with a distinct goal to reinvigorate the classroom, and return students attention back to the content of the class. However, educational researchers should place less emphasis on the narrow-focused skills, perspectives and educational content offered by existing computer games (Gros, 2007). Instead, it is the structural elements of computer games that should be used to enhance the educational experience as a whole. However, it is perceived gamification delivers educators an easily implementable set of mechanics that can integrate into existing curricula with very little effort or disruption to existing practices and procedures.

This paper discusses how gamification aligns and can be used within curricula, to demonstrate the affordances of a gamified pedagogy. In addition to this, a comparison of engagement factors inherent in the fundamental game mechanics on which gamification relies has also been generated. The research herein aims to reveal the affordances of gamification discovered in its use as a pedagogical tool in classes offered at Bond University. It begins with an examination of existing applications of gamification in the classroom followed by a comparative analysis of how the key attributes of engagement is critical to the success of both games and educational experiences. Next, a study that reveals the factors that may affect the successful integration and adoptions of gamification in a curriculum will be presented. The paper concludes with closing discussions and suggestions for further work.

Related Work

Gamification entered popular culture at the beginning of 2010 and has since penetrated into a plethora of domains including: business, marketing and education. Whether supported or opposed, what it does is bring together a selection of popular student engagement mechanics under the one umbrella term making them more accessible to educators.

Throughout the past two years, gamification has flourished in applications from weight-loss and exercise to teaching programming languages. Its popularity has even found it a place on the Gartner Hype Cycle. As of 2011, it has been situated in the trigger phase of the cycle; the first phase in which a new or novel technology, breakthrough or product launch gains significant attention. Early-adopter academics are inherently intrigued and eager to adopt new technologies with specific potential for education application, which provide opportunities to further engagement, motivation and loyalty in their student cohort. As such, gamification has been experimentally applied in a variety of classroom situations.

Cronk (2012) implemented a reward-based system to improve college student in-class participation and engagement in the form of a virtual tree that would grow in response to points assigned in class. This study reported an increase in student in-class participation. In an attempt to integrate game mechanics into an engineering curriculum, researchers at St. Cloud State University and the University of Wyoming implemented a points-based system that allowed students to progress through three levels. Through the use of rapid feedback mechanisms, the researchers found students motivated to engage in the given tasks (Thamvichai & Supanakorn-Davila, 2012). One of the most thorough applications of gamification in the classroom is that of Sheldon (2011). His classroom takes the form of a massively multiplayer game in which students are divided into guilds and compete in quests to gain experience points (XP). In the end, XP translate into traditional letter grades. Although there is no formal research presented for Sheldon's structure, the students do report favourably to the classes in the end of semester class evaluations.

Inspired by Sheldon's work, de Byl (2013) developed a gamified curriculum in which XP was awarded instead of grades, the ability to level-up by completing extra-curricula work and weekly team-based content revision quizzes. From a study of student engagement on the curriculum, de Byl (2013) identified five orthogonal dimensions which influenced students in her gamified curriculum; playfulness, alternative pedagogies, instrumentalism, status and performance. The playfulness dimension considers students who are playful, and those who are not. Its revelation is not unexpected given that play is the foundation on which gamification relies. Playfulness as a dimension of gamification suggests this reward system may provide students with acceptable mechanics keyed at deep and independent motivated learning as play itself is considered an experience with intrinsic motives (Henricks, 1999).

The second dimension, alternative pedagogies, at its extremes includes students who prefer traditional teaching methods (such as lectures and tutorials) and those open to more novel pedagogies (such as action-learning and games-based learning). Lectures remain the most fundamental teaching practice throughout the majority of education institutions around the world, although there are significant amounts of literature criticising this pedagogical technique. At its core, gamifying the curriculum is essentially a revival of the token economy method; this means the barriers typically encountered when implementing new technologies need not be applied.

Instrumentalism encompasses both students who are single minded and require the shortest path to success and those who are happy to explore and take instruction on a daily basis. Instrumentalist students respond well to a clear plan of the course and knowing exactly what to do and when in order to achieve the best grade possible. By breaking down tasks into equal-weighted activities (worth XP), gamification can provide students with a clear plan for students to follow, which according to Skinner & Belmont (1993) offers instrumental support.

The fourth dimension, status, ranges from students who prefer to know where they sit with respect to grades in the overall class, to those less concerned. Finally performance, the fifth dimension, relates to a student's ability to perform at their best. In order for students to succeed, they must know 1) what good performance is; 2) how their current performance rates with respect to good performance; and, 3) how to turn their current performance into good performance (Sadler, 1989). Gamified systems make performance data available giving players options to gain more points and to reach higher levels.

The data collected for the original five dimensional model of a gamified curriculum was based on a student engagement survey, although the effect of the gamified curriculum on student engagement was not analysed or presented in that study. To contribute to the literature and understanding of the affordances of gamification in education, this paper continues with an elucidation of engagement in education and games followed by an investigation into the influences of the five dimensions of a gamified curriculum on student engagement.

Aligning Engagement Theories in Education and Games

Student engagement is defined as "an individual's involvement with the educationally relevant activities and conditions that are instrumental to their learning." (Coates, 2006). The compulsion to include game mechanics in education is great among educators who want to engage and motivate today's students. When one sees how technology and computer games grab and maintain the attention of players, it is of little wonder teachers are looking for their holy grail in the same domain. The factors contributing to successful student engagement are strongly aligned with those presented in games.

Figure 1 presents the key attributes from the theories that apply to instructional design and game design. These attributes are prolific and common in key literature across both domains, and taken from Lepper & Malone (1987), Csikszentmihalyi (1990), Jones et.al (1994), Schlechty (1997), and Furlong & Christenson (2008).

Those considered to offer the greatest benefits in terms of engagement, shown in Figure 1, include:

- focused goals that give participants[7] a purpose for being involved in the system[8] and interacting with it;
- challenging tasks that are scaffolded and customised to a participant's skill level as to not be too easy or too difficult to achieve;
- clear instruction to provide rules, guidelines and scope to the system;
- rapid feedback to maintain constant communication with participants about their status and behaviours

[7] The "Participant" in this context refers to both students and players.

[8] The "system" may either be educational, or game-based.

within the scope of the system;

- affirmation of performance that communicates constructive quantitative and qualitative measures to participants about their progress toward their goals;
- social networking that allows inter-participant negotiation of knowledge for testing understandings;
- safety from failure such that the system constitutes a safe-haven in which participants are free to learn from mistakes without real-world repercussions;
- curiosity and novelty that provide intrinsic motivation to explore and push the boundaries of the system, and;
- fantasy to aid in suspension-of-disbelief and the use of imagination to create authentic problem-solving environments not elsewhere accessible to participants.

KEY ATTRIBUTES OF ENGAGEMENT

EDUCATION		GAMES
Students are more engaged when having to work on specific learning tasks. (Jones et al. 1994)(Schlechty, 1997) (Malone, 1980)	**FOCUSED GOALS**	Engagement only occurs where there is a connection to the player's own values and goals. (Draper, 1999)
The most effective learning is achieved by giving students tasks they can only achieve with the instructors guidance. (Vygotsky, 1978)	**CHALLENGING TASKS**	Optimal engagement comes from a challenge that adapts to a player's ability not being too difficult or too hard . (Csikszentmihalyi, 1990)
Educators can engage students by clearly communicating success criteria and depicting success as a realistic objective. (Strong et al., 1995)	**CLEAR INSTRUCTIONS**	Clear instructions must be provided and accessible throughout the game. (Barnes et al., 2007)
Engagement is mediated by rapid compelling action and feedback. (Norman & Spohrer, 1996)	**RAPID FEEDBACK**	Immediate feedback is critical in games to maintain engagement . (Malone, 1980) (Lepper & Malone, 1987) (Dempsey et al., 2002)
To succeed, students need to know what good performance is, how their performance rates with respect to good performance and how to improve. (Sadler, 1989)	**AFFIRMATION OF PERFORMANCE**	Visual feedback on performance is critical in maintaining player engagement with the game. (Garris et al. 2002)
Engagement is reliant on a student's sense of belonging and connection with parents, teachers, and peers. (Furlong & Christenson, 2008)	**SOCIAL NETWORKING**	Engaged players experience optimal enjoyment more frequently and value the importance of social interactions. (Chen et al., 2006)
The more attempts and failures there are, the more a student achieves mastery. (Duckworth, 1987)	**SAFETY FROM FAILURE**	Games provide players with a safe environment in which to make mistakes and practice skills without real-world repercussions. (Jones, 1998)
Learners with intrinsic motivation exhibiting epistemic curiosity. (Gagne, 1985)	**CURIOSITY & NOVELTY**	Mystery and curiosity is closely related to other dimensions in designing a game for engagement. (Frank, 2007)
Engagement is achieved by presenting material to students in an familiar/imaginary context or an attractive/fantasy context. (Lepper & Malone, 1987)	**FANTASY**	Engaging games can stimulate intrinsic curiosity because of challenge and game fantasy. (Yue & Zin, 2009)

Figure 1: The key attributes of engagement common to the domains of education and games.

The Study

Method

The study included four courses across two semesters of undergraduate students studying topics such as 3D Modelling, Animation and Game Design and Development; 31 students in total. The classes were run using de Byl's gamified curriculum structure presented in Section 2. At the end of the semester all students were surveyed to establish the effect the course structure had on their engagement. Questions for determining engagement were extracted from the National Survey of Student Engagement (NSSE) (www.nsse.iub.edu). The concept of a gamified curriculum was assessed using the survey, thereby benchmarking its efficacy. The survey consisted of sixteen questions measured on a five-point Likert scale, where "1" indicated strong agreement with the question, through to "5" indicating strong disagreement.

Results

The study in (de Byl, 2013) revealed the five factors described in Section 2 with an initial dataset from 22 students. With the addition of the new data presented here, the same five factors remained constant. Although the study uses a small dataset, a Kaiser-Meyer-Olkin (KMO) test result of 0.643 measuring the sampling adequacy indicates it is satisfactory for factor analysis and a Bartlett's test of sphericity result of 0.00 concludes the strength of the relationship among variables is strong.

Embedded within the survey were 6 questions aimed at gauging student engagement. The mean response for individual engagement was correlated with each of the gamified curriculum dimensions. The R^2 results for each dimensions effect on engagement are displayed in Table 1.

Table 1: Correlation between each gamified curriculum dimension and student engagement.

Dimension	R^2
Playfulness	*0.7*
Pedagogy	*0.7*
Instrumentalism	0.0
Status	0.0
Performance	0.3

Analysis & Discussion

The most significant correlation with student engagement was found between the playfulness and alternative pedagogy dimensions. This positive relationship, shown in Figure 2, suggests the most engaged students in the gamified classes were those that were playful, and preferred learning with alternative pedagogies. Interestingly, there was no significant correlation between the playfulness and pedagogy dimensions themselves ($R^2 = 0.2$) indicating the playful students were not necessarily the ones that preferred alternative pedagogies and vice versa.

These results are encouraging for the use of gamification in education. As the goal of gamification, in general, is to engage those who wouldn't otherwise play games, it is the nature of gamification itself to tease out playfulness even in those who wouldn't otherwise participate. While play is more commonly associated with early childhood learning rather than tertiary education, the evolution of play in children points towards a place and need for the types of playful experiences gamification can build throughout a curriculum. In children, play is linked with cognitive development (Vygotsky, 1978); from infancy through to preschool it is focused on the use of objects during social interaction - for example, playing with plastic tea sets. After the age of 4, children begin role-playing and using props and other objects for symbolic purposes, such as playing 'sword-fighting' where they use sticks or rolls of paper as swords. As children grow older, play begins to take structure and becomes defined by goals and rules - gradually transitioning towards actual gameplay.

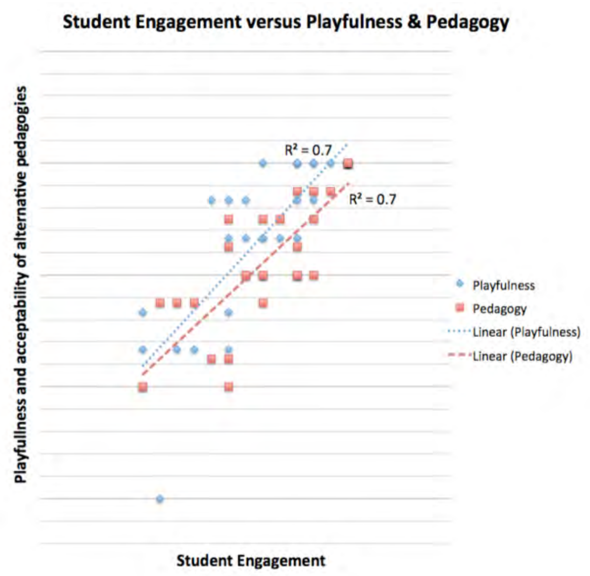

Figure 2: Student Engagement versus Playfulness & Pedagogy

Although education systems provide goals and rules of their own, they are not considered fun or playful. By implementing gamification atop an existing curriculum, content does not need to be compromised. Engagement can be increased through playful approaches to learning. Furthermore, playful learning matches several learning styles, each with their own strategies for implementation (Rice, 2009) and is integral in all learning environments first alluded to by Plato (Grube & Reeve, 1992) and reiterated more recently by Dickey (2003) and Kohler et al. (2012).

In a tertiary education environment the results of the study also suggest the need for alternate approaches to pedagogy in order to deliver playful learning experiences. Traditional educational systems lack meaningful forms of engagement, and although they present a method for knowledge transfer they do not consider all learning styles and preferred learning environments. Gamification is one way to explore further pedagogies without massive disruption to the underlying curriculum.

With respect to the research question presented at the beginning of this paper, the study herein reveals that gamification can support engagement in the classroom. It does so by affecting student engagement with respect to the dimensions of playfulness and alternative pedagogies from de Byl's five factors model. In the study, engagement was found to positively correlate with students' desire for a playful learning environment and alternative approaches to traditional lectures.

Conclusions & Further Work

Gamification may be perceived as a movement in its infancy however its roots are embedded strongly in the history of play, learning and games. The computer games industry feels that gamification cheapens its profession by not revealing the true depth of mechanics or an appreciation of the complexity of the design process. Indeed, while the game mechanics encompassed by gamification number few and essentially represent a mere facade of computer game points and reward systems the gameplay elements and mechanics in a AAA title number in the hundreds. Gamification has brought forward an opportunity for educators to provide a comprehensive framework by which playful learning in the context of serious adult level content can be realised. It does so with no disruption to effective pedagogical practice and provides the means to engage students in otherwise dry topic areas.

Furthermore, given the nature of the game mechanics of gamification it is not difficult to see the alignment between such a points-reward based system and an educational one. Marks students receive for completing assignments can be seen as points, and grades as levels or badges. Problem-solving activities and independent study align with quests and challenges. Unfortunately, if education is already considered gamified, it is indeed a weak example. Although education systems are structured on the surface as gamified, they differ in the amount of transparency with respect to goals, points, status and levels. In gamification, a player knows where they stand at all times and what they need to do next in order to progress to the next level. In the education system, assessment items may be marked on unequal scales, the amount of effort required to achieve each mark unbalanced, and in many cases students are in competition with each other for grades.

The motivation to include game mechanics in the curriculum is great among educators who want to engage today's students. However, without a thorough understanding of what a gamified curriculum looks like, how it can best be applied and why it might engage and motivate students, it cannot be effective. In addition, the way in which it affects the learning experience also needs further investigation. The results of the study presented herein suggest gamification mechanics can provide an engaging meta-layer atop existing educational content for playful and open-minded students. It should be noted however, the students in the study were from games and multimedia focused classes and it could be said these students may present naturally as more playful and open to alternative ways of learning. To determine the usefulness of gamification across academic disciplines and learning styles a more thorough investigation is required.

As Crawford (2011) states, "the fundamental motivation for all game-playing is to learn. This is the original motivation for game-playing, and surely retains much of its importance." Like it or loathe it, gamification is useful for inciting engagement, motivation and competition when used in the correct setting and for the correct purpose. With educators desperate to reignite their students' passion for learning, the application of some very fundamental ideas for interactivity and engagement, now embodied in what we now know as gamification, may help them reclaim their classrooms.

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Flexibility and function: Universal design for technology enhanced active classrooms

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This paper discusses the evolution of pedagogies used in technology enhanced learning spaces and their intersection with the principles of Universal Design for Learning (UDL). It also argues that as the next generation of computer integrated classrooms are built we must not forget to design for inclusion. UDL provides a framework for developing course content that can be effective for all students including those from various equity students in a technology rich environment. This paper discusses these factors and outlines some elements of a pilot project at the University of South Australia as it completes construction of a new seven-storey learning centre – the Jeffrey Smart building. The paper in part explores the linkages between the flipped classroom model and UDL and argues for the principles of universal design as a solution to the current pressures within higher education to teach effectively in technology rich environments and the need to be inclusive.

Kaywords: Universal Design for Learning, UDL, Flipped Classroom, Tech-Enhanced Learning Spaces.

Introduction

During the last twenty years computers have become ubiquitous across university campuses in Australia. These computers have typically been in rows in computer labs or scattered about in informal spaces for student use around the campus, typically in libraries or near recreation areas. The last decade has seen an evolution in the design of these types of computer integrated spaces and instead of computer integrated classrooms being made up of rows of screens they are instead formed by large tables, or pods, that enable students to face each other. A core feature of the design of the computer spaces relates to the democratisation of participation. For instance, the lecturer's position in the room is deemphasised with the integration of the lectern in to one of the pods. This design moves away from a pedagogical model of command and control to a model where the teachers is an active and value added node in the learning network. In essence, these classroom designs are a rejection of didactic teaching and learning styles and an acknowledgement of the growing acceptance of blended learning and pedagogies influenced by social constructivism.

The 2008 Bradley Review of Australian Higher Education makes an overt link between participation in higher education and social and economic development. Based on this the Australian Government announced targets in 2009, that by 2020, 20% of University students are to come from low socioeconomic status (low SES) backgrounds and by 2025, 40% of 25 to 34 year olds are to hold bachelor degrees. Meeting these targets will require a comprehensive and nuanced approach. Growing student numbers in this way, particularly in the context of South Australia's ageing population, means that an increasingly diverse student cohort will be part of the Australian HE sector in the near future, meaning that issues of equity and inclusion will be increasingly prominent. Catering for the educational needs of these diverse groups means that teaching and learning must be more inclusive so that we do not just attract diverse students but that we also retain them and help them to succeed. As Burgstahler (2008 p. 213) states, 'depending on how it is implemented, IT can either level the playing field or further widen the gap in educational attainment between individuals of minority groups (e.g.

individuals with disabilities, people from poor communities) and those of the majority.' In response to these intertwined requirements of inclusion and technology-rich classrooms and with the aim of levelling the playing field for our students the University of South Australia has begun designing and piloting courses using Universal Design for Learning (UDL) in our technology enhanced learning spaces. This paper discusses the context driving these developments and gives some examples of universally designed in-class tasks.

The Jeffrey Smart Building: UniSA's City West Learning Centre

The University of South Australia is currently completing the development of a new seven level learning centre at its City West campus. Four of these levels are dedicated to technology-enhanced classrooms for formal and informal use. There are no 'traditional' lecture theatres or tutorial rooms. The building has an innovative design, featuring integrated student services available on each floor of the building and an emphasis on tech-friendly informal student areas. The design and layout of the new building immediately indicate to both students and staff that a change is in the air with regards to the implemented model of teaching and learning. Learning is increasingly seen to be most effective when it is collaborative and social in nature and these ideas have influenced the design and implementation of the learning centre. Innovative spaces like this are a physical manifestation of this underlying philosophy, or what John Seely Brown has called the shift in education from 'learning about' to 'learning to be' (2006, p. 23) and in many ways spaces like these present an enormous challenge to many existing higher education pedagogies. This challenge to traditional ideas manifests further in the recent groundswell of attention for the concept of the 'flipped classroom'.

The new classrooms provide a flexible learning space consisting of nine person tables or pods, each table having three desktop computers with large touch screen monitors, with the opportunity for up to three students to work collaboratively at each station. There is also room to cater for additional laptops and other mobile devices with retractable HDMI and USB cables. Each table has a corresponding large wall mounted touch screen monitor and each table contains a document camera, with whiteboards on adjacent walls. The lecturer controls the display system of all pods via a switching system, allowing students to see either the same view, or their own view. Other equipment includes lapel and handheld microphones and a touch pen that can be used as a mouse or annotation tool.

These classrooms offer a huge range of potential learning activities, allowing students to interact with the space through independent study, teacher-led sessions or through group-work with peers. Explicitly, the types of activities that are best suited to these spaces are collaborative in nature and are about pedagogies that encourage active learning and collaboration. This means collaboration and collaborative learning between lecturer-student & student-student. If as Gerry Stahl states in his 2004 work on collaboration theory, that 'the extending of group knowing – is constructed in social interactions', then facilitating highly effective interactions between students will be an important element of the classrooms design. This type of room is also an excellent venue for dissemination, research, improvement of digital literacy and many activities that fall within the spectrum of blended learning, including the implementation of the flipped classroom. Key drivers for this convergence of technology and innovative classroom design include:

- Student-centred and active learning pedagogies influenced by social constructivism.
- Recognition of the need to educate students for the world unfolding before them and the need to invest in and develop lifelong learning and collaborative skills.
- The availability of technology and infrastructure.
- Student preference - 'Digital-age students want an active learning experience that is social participatory and supported by rich media' (McLoughlin & Lee, 2010, p. 28).
- In the case of the University of South Australia, the development of a Personal Learning Environment including a fully integrated institution-wide LMS, ePortfolio & Virtual classroom system (Dinmore, Kehrwald, Bradford, 2011).

As well as being an acknowledgement that the lecture-tutorial model, or what Claxton (2012, p. 78) calls the 'sedentary and disembodied approach', is not effective for many students, the evolution towards using these kinds of learning spaces is also recognition of the changing role of the university in Australia. As McLoughlin & Lee (2010, p. 37) suggest, 'The essential difference in the role of the institution is a move from delivery of content to a focus on designing experiences to facilitate personal learning, capability building and skills development, combined with a renewed emphasis on curriculum design that values the student's voice and needs in shaping decision making.' The design and intent of this learning centre is to be part of this new environment in Australian higher education.

Inclusion and Equity

This context of valuing the student's voice and needs means it is important that our teaching practices exemplify an inclusive approach. As educators it is perhaps easy to forget that next generation learning spaces are potentially intimidating places for new students. This factor could apply to those from equity groups and 'traditional' students alike. It is also the case that some students will be coming to the university with a set of expectations that will be confounded when they are asked to attend classes in the new learning spaces. Therefore, an excellent course and task design, a well thought out communication strategy, a high level of competency from staff and an inclusive environment are all essential for success. In response to this need for effectively designed pedagogies for the new learning spaces and the need to be inclusive it was decided to pilot Universal Design for Learning (UDL) in rooms constructed as prototypes of the new learning centre. Universal Design for Learning was developed by the Centre for Applied Special Technology (CAST) in the US, and is about removing barriers to learning for students. It is a set of principles for curriculum development that offers all individuals equal opportunities to learn. The three central principles (CAST, 2011) are:

1. Provide multiple means of Representation
2. Provide multiple means of Action and Expression
3. Provide multiple means of Engagement

Through this multiple provision of course materials and activities students from a huge range of backgrounds and learning styles are operating on a more level playing field within the course. UDL is also about guiding students to become expert lifelong learners and outlines a process to teach effectively, not just equity groups but ALL students. The United States Government through its *Higher Education Opportunity Act of 2008*, stated: 'The term UNIVERSAL DESIGN FOR LEARNING means a scientifically valid framework for guiding educational practice that […] provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged' (Edyburn 2010, p. 34). So flexibility is at the heart of UDL and it is precisely this factor that makes it extremely well suited for the technology rich networked classroom.

Universal Design in the Flipped Classroom

UDL pedagogies are most effective in a technology-rich environment, due to the relatively easy process of building in the accessibility and portability afforded by multimedia and the Internet. Edyburn (2010, p. 38) proposes that technology is essential for implementing UDL noting that 'paper-based instructional technologies (e.g., worksheets, textbooks) commit information to fixed formats and cannot match the array and flexibility of supports provided in a digital environment.' Burgstahler (2008 p. 29) describes some of the advantages of the digital environment to inclusive teaching;

> Flexible components are built in to digital materials to benefit students with learning disabilities; with attention issues; with behavioural problems; or with physical or sensory disabilities. They also benefit those who are learning a new language; who have attention deficits; or who have other characteristics that make taking notes, reading, understanding auditory information, paying attention, handwriting, or spelling difficult.

For example, UDL pedagogies are well suited for use in something like a flipped classroom model. Indeed, there are many similarities. They both;

1. Have the concept of flexibility at their core.
2. Rely on a technology rich environment with groups of networked learners.
3. Encourage self-paced learning through the provision of Internet based materials.
4. Rely on a high level of explicit communication with students facilitated by ICT.

If, as Rose & Meyer state (2002), 'The central practical premise of UDL is that a curriculum should include alternatives to make it accessible and appropriate for individuals with different backgrounds, learning styles, abilities, and disabilities in widely varied learning contexts', then a technology enhanced environment would be almost the ideal venue for its successful implementation. Universal Design is about leveraging the available technology to create as wide a range of options as possible for students and to steadily build flexibility in to the course at every level. With this in mind and drawing on the three central principles of UDL, mentioned above, this section outlines some examples of universally designed in-class tasks for a technology rich classroom.

Table 1: Examples of universally designed in-class tasks

1. Providing multiple means of Representation - How do I present essential course content to my students? Lecture material – A technology-enhanced classroom has the advantage of being able to represent information to students in a variety of ways simultaneously. Effective use of multimedia allows various modes of presenting information e.g. a lecture/topic podcasts can be created with annotations or captions, and also be available as a written transcript. Course homepage – The LMS course page was redesigned as a graphic organiser - in the form of a grid. This type of graphic representation of the course material removes unnecessary complexity and removes the need for scrolling through deep pages. This grid is also available as a taggable PDF (available to download next to the main grid) so it can be scanned by OCR (Optical Character Recognition) software. MOODLE, for example, has many accessibility options built in, these include variable display of fonts for colour-blindness and dyslexia and translation through the use of language packs. Course materials, key concepts and processes can be communicated to students through the use of graphic organisers. Venn diagrams and flowcharts created in tandem with your other course material can be effectively displayed online and help to scaffold learning for a wider range of learners.
2. Providing multiple means of Action and Expression - How do I get my students to show what they know? Student's voices in-class - Many students find it hard to express themselves orally for a number of reasons. A web-based application like PADLET (a collaborative wall online on which text, pictures and videos can be added in boxes) is an excellent venue for in-class discussions or class debates and can be part of a strategy, including small group work, individual reflection and student presentations to allow multiple avenues for expression in the classroom.
Multi-media – An assignment that is normally assessed as a report with a one-size-fits-all template has now been changed to allow students various means of expression. Students can illustrate their mastery of a key course topic through the means of a traditional report, a website, a PowerPoint presentation or as a video recorded interview.
3. Providing multiple means of Engagement - How do I involve my students in the learning process? ePortfolios – eP's encourage a wide range of student engagement modes. In this case students are working in small groups using GLOGSTER (an online tool for creating interactive posters) to create posters on course topics that will be displayed to the whole class in a 'conference' format. Time is allocated each week for a number of weeks to allow for structured group work supported by interaction with instructors. The various posters are displayed through each student's ePortfolio (in this case Mahara) to the rest of the class using the touchscreens next to each pod. Through the ePortfolio feedback mechanism the students review and mark each other's posters in a poster defense. Students then reflect on the process, and their grade. Online students can also participate in this process with the rest of the class as a means of opening up communication between internal and external students fostering community and collaboration.

Conclusion

Ultimately, the current contexts, outlined above, signal a radical cultural shift in higher education. As Rose and Gravel (2012, p. 27) suggest, 'what will separate the new curricula from old is that they will reflect a new ecology for learning. That new ecology will put students at the centre of the learning environment.' The new Jeffrey Smart building gives us this opportunity to develop and deliver innovative, inclusive pedagogy and a new ecology for learning that centres on students. If our approach to using it is strategic and research driven and we support those wanting to teach in the space, to provide authentic learning experiences for students, then we will be realising our ambitions. The way that we, as a sector, rise to meet the challenge of inclusive teaching practice in technology-rich classrooms will help define the Australian higher education and our students in the years to come.

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Applied learning in online spaces: Traditional pedagogies informing educational design for today's learners.

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The challenge to provide engaging, effective learning environments for university students is perhaps greater now than ever before. While the 'anytime, anywhere' online learning environment appeals, students also need a learning environment that encourages and retains their engagement. A new teacher-education program with an explicit focus on applied learning commenced at the University of Tasmania in 2011. The fully online course aims to provide an authentic, engaging environment for the students, who are primarily mature-aged, in-service teachers in TAFE colleges. This paper describes the applied learning design principles created to guide the course development and delivery, and the initial findings of a doctoral study being undertaken to examine their effectiveness. The research aims to provide a set of tested design principles to encourage and support an applied learning approach in online teacher-education courses, and more broadly in higher education.

Keywords: e-learning, applied learning, authentic, online, teacher education.

Introduction

Like many other nations, Australia hopes to increase the percentage of the population who have succeeded at university, with the Bradley Report (2008) setting a target of 40% of 25-34 year-olds holding Bachelor level qualifications by 2020. This has important implications for providers, given that such an aspiration entails a more diverse student cohort. Compared to a generation ago, today's student is more likely to be older, first-in-family to attend university, and combining study with work and family commitments (Munro, 2011). There is a strong imperative to design effective, engaging learning environments for these non-traditional students, many of whom will by necessity or by preference, seek an online mode of learning.

An undergraduate teacher-education course first offered in 2011 at the University of Tasmania is attracting students who typify the characteristics of non-traditional students. The course is aimed at teachers employed in vocational education and training (VET) settings, including TAFEs, hospitality colleges or VET in School programs. For many of the students, it is their first experience of study at university and is a challenging undertaking. Course designers considered how to embed an applied learning approach that could also be seen as a model for the students' own vocational education settings, while being delivered in a fully online mode of study. The literature review and consultation sessions provided the foundation for the draft design principles that are now guiding the development and delivery of the course. This paper describes the design principles, their theoretical underpinnings and their initial implementation. The resulting experience for students and teaching staff is the subject of an ongoing doctoral study, with initial findings from the first iteration being described in this paper.

Research methodology

The methodological framework for the study is design-based research. This is also referred to as design research, educational design research, design experiments and development research, and although similar to action research, it goes beyond that methodology by involving an iterative process of analysis, design, development and implementation of a specially designed model (Phillips, McNaught, & Kennedy, 2012). There are four phases in design-based research (see Figure 1 below), as depicted by Reeves (2006).

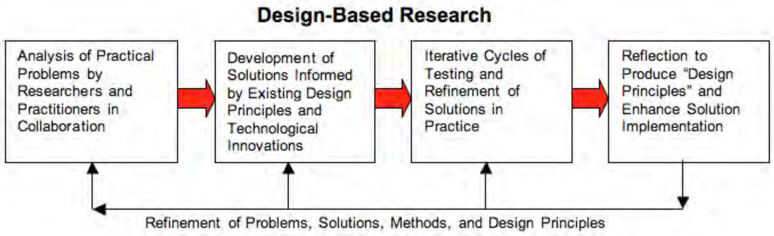

Figure 1: Iterative phases of design-based research (Reeves, 2006, p. 59)

Each phase of the study is described in more detail below.

Phase One: Analysis of a practical problem

The first phase of the study involved a multi-pronged approach to identify and articulate both the vision for the course and the practical challenges faced by prospective students. It was anticipated that the majority of incoming students would be mature-aged and balancing study with employment and family life. Typically, such students will not continue in their studies if they do not perceive adequate benefits from participation (Bartram, 2009). It was critical to imagine the student experience and consider the necessary pedagogical approaches to ensure an engaging, rewarding learning environment. Course designers also visited VET campuses in Tasmania where teachers who were prospective students in the course were invited to articulate their hopes, fears and expectations. The findings from this initial stage highlighted the need for a supportive environment, with course content and activities responsive to the everyday needs of the teachers working in applied learning settings, and flexibly delivered and assessed. This phase also included informal consultations with current students and recent graduates from existing teacher-education courses, to garner a picture of the current student experience in pre-service courses in the Faculty of Education.

Course designers then reviewed educational literature, focussing largely on constructs related to theoretical perspectives on learning and teaching, and models of teacher education that recognised the value of an applied, authentic approach. There were five theoretical constructs examined in this phase: applied learning, authentic learning, realistic teacher education, situated learning, and reflective practice. These will now be briefly reviewed.

Applied Learning

The term 'applied learning' evokes images of learning trade skills with your hands. Theoretically, it is most closely aligned with experiential learning (Dewey, 1938, Kolb, 1984), and is commonly associated with vocational and post-compulsory education. Applied learning pedagogy emphasises connections between what is being learnt and the 'real world' of work, focussing on the knowledge and skills that will be required in the discipline. Ash and Clayton (2009) describe the pedagogical approach of applied learning as being:

> ..grounded in the conviction that learning is maximized when it is active, engaged and collaborative. Each applied learning pedagogy provides students with opportunities to connect theory with practice, to learn in unfamiliar contexts, to interact with others unlike themselves and to practice using knowledge and skills (p. 25).

Importantly, applied learning focuses on the student rather than the curriculum, and encourages the development of a sense of independence and responsibility for learning and performance (Ash & Clayton, 2009). While most commonly associated with vocational education, it is extending into the higher education sector through "the kind of pedagogical principles and practices associated with engaged scholarship, communities of practice, civil engagement, and critical pedagogy" (Schwartzman & Bouas Henry, 2009, p. 5). Applied learning, therefore, sits comfortably within the broad principles of adult education (Knowles, Holton, & Swanson, 2011), situated learning (Brown, Collins & Duguid, 1989), and communities of practice (Lave & Wenger, 1991).

Authentic learning

As industry calls for more 'work-ready' graduates (Korthagen, Loughran, & Russel, 2006), the value of authenticity within learning and assessment strategies has become obvious to a growing number of educational providers. Although an agreed definition of authentic learning is elusive, it is commonly agreed that the term is closely associated with an instructional design and teaching approach that encourages students to gain, and use knowledge and skills in a way that is akin to how it will be used in 'real' contexts. Such strategies are based on a constructivist orientation to learning, and designed to foster a deep understanding and competence in the students through purposeful activity and engagement with tasks (Biggs, 2011). An authentic learning approach places the focus on the learner, rather than the subject to be taught, and suggests that learning is the function of the activity, context and culture in which it occurs, or is situated (Brown, Collins & Duguid, 1989). While the challenges of achieving this within the context of a unit of study in a university setting are acknowledged (Boud, 1998, Lombardi, 2007) authentic learning environments appear likely to encourage greater student interest and improve learning outcomes.

A framework proposed by Herrington, Reeves and Oliver (2010) builds on their earlier work (see for example, Herrington, 1997; Herrington & Herrington, 2006) and contains nine principles to guide course designers and teaching staff in the development of an authentic learning environment within an online environment in higher educational settings. These principles are:

1. Provide authentic contexts that reflect the way the knowledge will be used in real life
2. Provide authentic tasks and activities
3. Provide access to expert performances and the modelling of processes
4. Provide multiple roles and perspectives
5. Support collaborative construction of knowledge
6. Promote reflection to enable abstractions to be formed
7. Promote articulation to enable tacit knowledge to be made explicit
8. Provide coaching and scaffolding by the teacher at critical times
9. Provide for authentic assessment of learning within the tasks (Herrington et al., 2010, p. 18).

Their framework offers a response to the criticisms of traditional pedagogical approaches, particularly in higher education settings, of a teacher-led, overly theoretical environment, devoid of connection with the students' future workplace. Rather, students become active, engaged participants in their learning, solving problems by exploring a range of options and recognising the complexity and multiplicity of issues related to the situation. Essentially, an authentic approach makes the learning of the discipline similar to the practice of the discipline (Rosenbaum, Klopfer, & Perry, 2007) and thus should prepare students well for their intended profession.

Realistic teacher education

Practitioners in teacher-education are increasingly aware of the need for an applied approach in their courses. Today's schools are calling for education graduates who can make connections with their students and foster the skills and knowledge needed in a fast moving society. Korthagen's (2001) model of Realistic Teacher Education responds to this need. His model brings together his beliefs about students, learning, teacher behaviour and teacher education. Korthagen (2001, p. ix) recalls his personal revelation when he began his mathematics teaching career: "I realised that to these kids school was not so much a place to learn mathematics, but a meeting place to learn about life". Henceforth, he changed his own teaching methods to reflect his belief that children could and should be presented with practical problems, be guided in formulating solutions, and from that process, develop mathematical notions that will inform future situations.

When Korthagen transitioned into teacher-education, he applied the same philosophy, recognising the value of concrete experiences and subsequent reflections to encourage the development of theoretical notions about learning and teaching. Korthagen's model promotes extended periods of placement in schools as a way to ensure an applied approach to education, and this approach is gaining popularity in several countries in Europe and the United Kingdom (Boffey, 2011). However, ensuring the consistency of student experience in school placements is problematic, with a significant diversity in the quality of colleague-teacher input and support offered to the participants (Zeichner, 2010). Korthagen's (2001) model of teacher education offers universities an opportunity to consider how the student experience on campus, or online, can also offer an authentic, applied approach to their academic and professional development.

Situated learning
Publications in the 1980s raised awareness and a greater understanding of how knowledge, learning, and the world of work were interconnected. The seminal work of Brown, Collins and Duguid (1989) recognised the importance of the domain, or context, to the process of learning. They proposed that "[s]ituations might be said to co-produce knowledge through activity. Learning and cognition, it is now possible to argue, are fundamentally situated" (p. 32). Their findings revealed that not only was the selection process of particular cognitive strategies influenced by the particular domain, but also the domain itself was responsible for the production of knowledge. Learning, cognition and knowledge were now all acknowledged as fundamentally bounded by the situation. Brown, et al. (1989) connects situated learning with students in school, suggesting that a traditional approach with abstract concepts and self-contained examples may not be effective (p. 34). Instead they promote that:

> Authentic activity, as we have argued, is important for learners, because it is the only way they gain access to the standpoint that enables practitioners to act meaningfully and purposefully. It is activity that shapes or hones their tools (p. 36).

Educational settings, whether bricks and mortar or online, do not easily lend themselves to be authentic learning places. As a result, the option to explore work-integrated-learning (WIL) placements is often the assumed position. Yet the published research reveals an active and exciting discourse on the potential, possibilities, and challenges of creating authentic learning environments, for both on-campus and online students (see for example, Boffey, 2011; Darling-Hammond, 2000; Grossman, Hammerness, & McDonald, 2009; Phillips, McNaught, & Kennedy, 2012).

Reflective practice
In a fast-moving world, the value of developing reflective practitioners is obvious. Organisations value employees who can think of new ways of doing things, based on reflection on past action and the potential offered in changing environments. The view of teachers as 'reflective practitioners' has developed significantly since the mid-1970s, mirroring the broader acceptance of teachers as professionals who aim to better understand and improve their teaching practice. The literature related to reflection in education reveals several conceptualisations of the term, and these align nicely with an applied learning approach. Dewey (1938) provides an early foundation to reflective practice, with his suggestion that reflection entails a 'chain of thoughts', that "are linked together so that there is a sustained movement to a common end" (p. 5). He defines reflection as "active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends" (p. 9). This draws our attention to the intellectual demands of critical reflection, and the requirement for commitment and perseverance.

Schön (1983) distinguishes between two different types of reflection; one that occurs at the time where action would still make a difference to the situation, *reflection-in-action,* and then also the reflection that can take place on past events, *reflection-on-action.* Both forms of reflection require considered attention and the belief that the outcomes will inform future actions and behaviour. Reflection challenges a practitioner to examine their own personal theories, and hence, offers potential development of those theories. This is a skill that develops over time, and similarly to Dewey, Schön (1987) suggests a correlation between the experience of the practitioner and the value of the reflection. Rogers (2002, p. 853) supports the value of continuing development of reflective skills, suggesting that: "The store of one's wisdom is the result of the extent of one's reflection".

Contributors to the teacher-education field, such as Brookfield (1995) also promote the value of reflective practice. He offers a model for reflection that invites practitioners to view their teaching through four lenses: their own autobiographies as teachers and learners, their students' eyes, their colleagues' eyes and scholarly literature. Brookfield believes that by viewing our teaching practice through multiple lenses we are able to identify "distorted or incomplete aspects of our assumptions that need further investigation" (p. 29). Brookfield's model of reflection sits comfortably with an applied learning environment, where authentic learning and assessment tasks will enable students to examine their practice through multiple lenses. Not only will such critical refection help students to gain the knowledge and skills required for success in higher education, but it will form the foundation for habits of reflective practice long after they leave their university and develop their careers as professional practitioners.

Phase Two: Development of the solution

This phase involved the creation of a set of design principles to guide the development and delivery of the new teacher-education course. The principles were informed by the preceding phase where prospective students, Faculty teaching staff and theoretical constructs contributed to building a shared vision for what the course would be; philosophically, pedagogically and experientially. The principles, along with accompanying notes and suggestions on possible ways to enact them, were posted on a shared online space for easy access by course developers and teaching staff.

Principles of Applied Learning in Higher Education:

1. Provide authentic contexts and applied learning activities that connect theory and practice;
2. Recognise and incorporate the lived experience of students;
3. Provide opportunities for meaningful, collaborative construction of knowledge within the learning community;
4. Encourage the development of a reflective, professional identify through collegial interactions in a variety of settings;
5. Provide authentic assessment tasks that reflect the way the knowledge will be used in real work settings; and,
6. Encourage student ownership of learning and increasing professional autonomy.

Implementation of the principles:

The design principles have guided the development, delivery and evaluation of the teacher-education course from its commencement in 2011. The course is constructed within the *Desire2Learn* Learning Management System, and all students are enrolled in a fully online mode of study. The learning environment consists of a variety of strategies and resources, such as guiding notes for students, scholarly readings, practical activities and recorded interviews with subject experts, such as industry practitioners and educational specialists. Students and teaching staff communicate and collaborate via discussion boards (asynchronous), wikis, blogs, web-conferences and Skype communications. Students who are in-service teachers integrate their everyday working experience and demands into their learning and assessment strategies, while pre-service students draw upon their professional or volunteer placements in colleges or schools. The principles can be used as a guide, a checklist, or evaluation criteria for designers or teaching staff. In Table 1, each draft principle is listed together with its enactment or instantiation within the learning environment, and the relevant theory from which each principle is drawn.

Table 1: Enactment of design principles and associated theory

Principle	Students will:	Associated theory
1. Provide authentic contexts and applied learning activities that connect theory and practice	• Draw upon their own, authentic, contexts as they are exposed to and consider theoretical concepts within education. • Engage in critical reflection on past events, engagement with current situations (through practicum placements as well as their everyday experiences for those already teaching) and imagining future events within their own contexts. • Be involved in tasks that will mirror or draw upon the actual working environment, ensuring that the cognitive demands are similar to what will be/is expected in the workplace. The tasks will be, therefore, often ill-defined and multi-faceted, and require completion over a sustained period of time.	Experiential Learning Theory (Dewey, 1938) Authentic Learning (Herrington et al., 2010) Reflective practice (Brookfield, 1995; Schön, 1983) Situated learning (Brown, Collins, & Duguid, 1989) Realistic Teacher Education (Korthagen, 2001)
2. Recognise and incorporate the lived experience of students	• Be encouraged to draw upon their experiences, perspectives and roles and invited to identify differing point of views that may exist on particular situations and (re)consider the complexity of educational settings. • Participate in practicums and reflect on those experiences with peers and teaching staff in online blogs, discussions and wikis.	Adult learning theory (Knowles et al., 2011) Authentic Learning (Herrington et al., 2010) Realistic Teacher Education (Korthagen, 2001) Professional and teacher education (Rogers, 1969; Shulman, 1998)
3. Provide opportunities for meaningful, collaborative construction of knowledge within the learning community	• Work together collaboratively in each unit within the course. Activities such as collaboratively created Wikis, Blogs, group journals and the online discussion board activities will be included to ensure that all students have regular opportunities to engage and learn with and from each other. • Be encouraged to take on leadership roles within the student community in areas where they feel comfortable and competent, drawing upon their previous experiences in teaching or learning environments.	Authentic Learning (Herrington et al., 2010) Situated learning (Brown et al., 1989) Realistic Teacher Education (Korthagen, 2001) Communities of Practice (Lave & Wenger, 1991)
4. Encourage the development of a reflective, professional identity through collegial interactions in a variety of settings	• Be involved in authentic tasks that enable them to reflect meaningfully, incorporating both their present activities within the course, and also drawing upon their previous experiences as teachers and as students. Collaborative reflection will be possible through the use of shared e-journals, blogs and discussion groups. • Be encouraged to identify and reflect on their existing beliefs that may have formed over many years, and be encouraged to consider how and to what extent their beliefs are evolving (or even transforming) through continued professional practice and their studies at university. • Be actively involved in both identifying and articulating their tacit knowledge. Robust discussion and debates centred on everyday teaching p c c s w d w o s d s' b fs d q h m o	Adult learning theory (andragogy) (Knowles et al., 2011) Authentic Learning (Herrington et al., 2010) Realistic Teacher Education (Korthagen, 2001) Professional and teacher education (Rogers, 1969; Shulman, 1998) Reflective practice (Brookfield, 1995; Schön, 1983)

Principle	Students will:	Associated theory
	clearly communicate and justify their attitudes, beliefs and values. • Have a growing appreciation of the complexity of the workplace and cog s h c y c g o 's pos o s ssential trait of an effective educator.	
5. Provide authentic assessment tasks that reflect the way the knowledge will be used in real work settings	• Experience assessment tasks that draw upon the required skills and knowledge in their future workplaces, and which acknowledge the complexity and subjectiveness of such places. • Create practical products that will be meaningful in their daily teaching practices. • Collaborate with others as part of the assessment preparation process, recognising the context of the real working world. • Often complete a variety of tasks within the one assessment item, and draw upon work completed in the learning activities as part of the assessment process (i.e., integrated authentic assessment).	Authentic Learning (Herrington et al., 2010) Situated learning (Brown et al., 1989) Realistic Teacher Education (Korthagen, 2001) Communities of Practice (Lave & Wenger, 1991)
6. Encourage student ownership of learning and increasing professional autonomy	• Be encouraged to see the point of what they are learning and be free to adopt their own conceptions rather than simply adopting the views of others, and perhaps particularly, their teachers. • Be encouraged to be authentic themselves; to consider and reflect on how they will engage with the material and activities, take ownership of what they learn, and decide how to enact their philosophical beliefs about teaching • Be encouraged to be increasingly responsibility for their learning while knowing that teaching staff will continue to provide support as required. Students will draw upon a range of resources and activities that will help them achieve the learning outcomes rather than feeling like they must complete a set of disparate tasks in order to succeed. • Be invited to take on a supportive role themselves, particularly with their less experienced peers.	Professional and teacher education (Rogers, 1969; Shulman, 1998) Realistic Teacher Education (Korthagen, 2001) Communities of Practice (Lave & Wenger, 1991) Reflective practice (Brookfield, 1995; Schön, 1983) Authentic learning (Herrington et al., 2010)

Phase Three: Implementation and evaluation in cycles

In Phase 3, the design principles are enacted into the course and the cycles of implementation are conducted. To date, the first of three planned iterations has been completed. Aligned with the research design, the applied learning design principles will be reviewed and modified at the conclusion of each iteration, in light of feedback and reflection. Each iteration consists of one semester (13 weeks), meaning that Phase 3 will be completed in mid-2014. The fourth phase will then commence, incorporating reflection and production of the final, enhanced design principles.

Context and data collection methods

Both qualitative and quantitative data collection methods are being used to collect data from students and teaching staff, in order to build a robust picture of the effectiveness of the principles being researched. Qualitative data is collected via focus groups, semi-structured interviews and electronic artefacts produced by students as part of their studies. Quantitative data is collected through an electronic survey distributed to all student participants. Such mixed method research is useful in educational research (Johnson & Onwuegbuzie, 2004), recognising the value of both types of data, and legitimatising multiple approaches to answering the research questions.

All students in the course with an active enrolment in Semester 1, 2013, were invited to become participants in the research study. Additionally, two academics teaching into the course (one of whom is the researcher) are participants. All student participants are in their first or second year of the course. Students were invited to become participants via email invitations, accompanied by an Information Sheet describing the research project. The email also invited the students to participate in the first research instrument, an electronic survey. Completion of the survey was taken as implied consent to be a participant in that aspect of the study. The survey was completed anonymously, and then those willing to participate in other aspects of the study were redirected to another site to leave contact details. These participants were then sent Consent Forms to complete and return to the researcher. At the conclusion of the semester, and after the finalisation of academic results, two focus groups were conducted, one for first semester students, and one for those students who had studied for three or more semesters. Six participants were invited, and agreed, to attend the appropriate focus group. Selection of those invited was based on a desire to have a range of age, geographical location and gender represented. Following the focus groups, two first semester participants and two third semester participants were randomly selected for interviews. All interviews and focus group discussions were recorded and transcribed. The analysis of the first iteration of data collection is presented in the following section.

Initial findings and discussion

In June 2013, the first electronic survey was completed by participants. Forty of the possible 89 students agreed to become participants in the study and completed the first research instrument. This represents a pleasing response rate of 46%, with most (33) of the participants also agreeing to be available for interviews and focus groups. Participants are largely female (76%), and most are between 30 and 50 years old (73% fall into this age category). Participants are principally from Tasmania (61%), but most other states and territories are represented in the sample. All students study externally, regardless of physical location. Close to half the participants (49%) are in their first semester of study, with the balance of students in their third or later semester of study. Nearly half the participants (49%) listed their highest educational qualification as a vocational certificates or diplomas, with the balance of the students having either incomplete or completed higher education qualifications. The survey sought to explore the expectations of students, and identify if and how these expectations might change as the students progressed in the course. Following the e-survey, emerging themes were explored through two focus groups using Collaborate web-conferences, as well as four interviews with participants. All qualitative data was transcribed, and then coded using NVivo software. Quantitative data was exported into Microsoft Excel and analysed. Selected results are reflected in Table 2 below.

Table 2: Importance of factors of the university experience, as ranked by first and third semester students.

First Semester Students (*n=20*)	Not at all important	Not very important	Unsure	Very important	Extremely important	Agreement that this had been experienced in the current semester
Regular interaction with teaching staff	0.0%	5.0%	5.0%	**70.0%**	20.0%	75%
Regular interaction with my student peers	0.0%	15.0%	20.0%	**45.0%**	20.0%	70%
Learning new skills I can use immediately	0.0%	5.0%	10.0%	**50.0%**	35.0%	85%
Having an online environment that allows anytime/where access	0.0%	0.0%	0.0%	45.0%	**55.0%**	95%
Sharing my own experiences with peers and teaching staff	0.0%	25.0%	10.0%	**60.0%**	5.0%	80%
Working collaboratively with peers	0.0%	20.0%	**40.0%**	20.0%	20.0%	45%
Assessment tasks that reflect the way knowledge will be used in real world settings	0.0%	0.0%	5.0%	**50.0%**	45.0%	85%
Developing academic skills	0.0%	0.0%	5.0%	**60.0%**	35.0%	95%
Developing professional skills	0.0%	0.0%	0.0%	**70.0%**	30.%	100%

Third Semester Students (*n=21)*	Not at all important	Not very important	Unsure	Very important	Extremely important	Agreement that this had been experienced in the current semester
Regular interaction with teaching staff	0.0%	4.8%	9.5%	33.3%	**52.4%**	86%
Regular interaction with my student peers	0.0%	0.0%	0.0%	**71.4%**	28.6%	86%
Learning new skills I can use immediately	0.0%	4.8%	14.3%	33.4%	**47.6%**	76%
Having an online environment that allows anytime/where access	0.0%	0.0%	0.0%	28.6%	**71.4%**	95%
Sharing my own experiences with peers and teaching staff	0.0%	4.8%	9.5%	**71.4%**	14.3%	95%
Working collaboratively with peers	0.0%	4.8%	19.1%	**57.1%**	19.0%	76%
Assessment tasks that reflect the way knowledge will be used in real world settings	0.0%	0.0%	4.8%	28.6%	**66.6%**	81%
Developing academic skills	4.8%	4.8%	9.5%	**66.7%**	14.3%	90%
Developing professional skills	0.0%	0.0%	0.0%	23.8%	**76.1%**	95%

Table 2 reflects that, generally, students believed their expectations had been met during the semester. There were, however, some interesting similarities and differences between the expectations of the first and third semester students. Similar values are held by both cohorts on the importance of regular interaction with teaching staff, learning new skills that can be used immediately, and having an online environment that allows anytime/anywhere access. Additionally, both cohorts reflect a valuing of assessment tasks that reflect the way knowledge will be used in the real work settings and the development of professional skills. In contrast, third semester students place a much higher value than the first semester students on several aspects of the course. In particular, these students indicate a greater belief in the importance of *regular interaction with their peers*, as well as *sharing their own experiences with peers and teaching staff*, and *working collaboratively with peers.* Many first semester students were not convinced that working collaboratively with peers was important (60% indicated that they were either unsure or did not consider this a very important factor), and only 45% believed that they had collaborated with peers during the semester. In contrast, only 24% of third semester students indicated that they were either unsure or did not consider this a very important factor, and a much higher percentage (76%) believed that they had collaborated with peers during the semester. This is explored further in Table 3, below.

Table 3: Collaborative learning

First Semester Students (*n=19*)	**Strongly disagree**	**Disagree**	**Neither agree or disagree**	**Agree**	**Strongly agree**
Working collaborative helped my learning	0.0%	0.0%	36.9%	42.1%	21.0%
I like doing collaborative learning activities	0.0%	15.8%	31.6%	42.1%	10.5%
The online environment is conducive to collaborating with peers	0.0%	10.5%	26.3%	57.7%	5.3%

Third Semester Students (*n=21*)	**Strongly disagree**	**Disagree**	**Neither agree or disagree**	**Agree**	**Strongly agree**
Working collaborative helped my learning	0.0%	0.0%	4.8%	57. %	38.1%
I like doing collaborative learning activities	0.0%	4.8%	23.8%	38.1%	33.3%
The online environment is conducive to collaborating with peers	0.0%	0.0%	23.8%	47.6%	28.6%

Overall (*n=40*)	**Strongly disagree**	**Disagree**	**Neither agree or disagree**	**Agree**	**Strongly agree**
Working collaborative helped my learning	0.0%	0.0%	20.0%	**50.0%**	30.0%
I like doing collaborative learning activities	0.0%	10.0%	27.5%	**40.0%**	22.5%
The online environment is conducive to collaborating with peers	0.0%	5.0%	25.0%	**52.5%**	17.5%

The questions relating to collaborative learning yield some mixed results. Most students agreed that working collaboratively helped with their learning, with more third semester students either *strongly agreeing or agreeing* with the statement (95% compared with 63% of first semester students). Slightly fewer students, however, seem to indicate a liking for collaborative tasks, with approximately one-third of students in the first semester and around a quarter in the third semester *neither agreeing nor disagreeing* with the statement. Approximately, 60% overall *agreed or strongly agreed* to liking collaborative tasks, compared to 80% who *agreed (or strongly agreed*) that it had helped their learning. Just over one-half of all students agreed that the online environment was conducive to collaborating with peers.

In a subsequent question, students were asked whether or not that would like collaborative assessment tasks to be included in units with the course. The students seemed split across this question with 37% responding that they *would not like* collaborative assessment to be included and 37% claiming to be *unsure*. Interestingly, more third semester students were open to the idea of collaborative assessment tasks than first semester students (33% opposed to 20% of students) suggesting that the idea of collaborative learning through assessment is more accepted later in the course. This outcome is similar to the second table presented where there was an increase in the perceived importance of collaborative work with peers from the first semester to the third semester. Typical reasons for students not wanting to include collaborative assessment items included not having time to coordinate schedules with other busy students, different working habits and styles, and often protracted hours in their place of employment.

Focus Groups and Interviews

Following an initial analysis of the e-survey data, two focus groups and four interviews were conducted, to further explore the enactment of the principles. Particular attention was given to exploring beliefs relating to collaboration with peers, for both learning and assessment strategies. This relates most closely to the third principle: *Provide opportunities for meaningful, collaborative construction of knowledge within the learning community.* At the time of writing, a complete analysis of the focus groups and interviews has not yet been completed, but the transcriptions reflect some interesting contributions. Participants shared their concerns over collaboration; a lack of confidence to contribute was a repeated concern, with following comment typical: "*I enjoyed reading the discussion boards to read what other people thought but I found it difficult to write to a standard that wouldn't make me look less educated*" (focus group comment). Time was also a common concern: "*So it did stress me a little that I was somewhat at the mercy of other people's busy schedules. One could not complete their assignment without the input of another*" (interview). Another concern related to a peer-review activity: "*People… want to be nice, so they're not critical. I've had assignments I've given to people where they've corrected my spelling and grammar, but nothing about the content*" (interview). Contrasting these concerns, participants were also aware of the potential benefits: "*As online students of the Applied Learning course it is impossible for us to work together in a physical sense, but like quick lunch-time chats in the staff room, I find a platform such as the discussion board useful as a collaborative tool that in some ways mirrors the workplace"* (interview). The benefit of learning from peers was also highlighted: "*I think in all units we have been encouraged to share our tasks …. I at first was a bit held back from doing this as I was a novice teacher and communicating with more experienced teachers. I now see we all see things differently and I have learnt so much that I can exercise within my own classes*" (interview). Perhaps the most telling comment came from a first semester student in a focus group: "*What part do you play in collaboration if you're in a group, whether it's in a wiki or it's in a discussion group or if it's in a joint assessment or whatever? I think a lot of people don't really understand what it actually is"*. This comment appears to indicate a need to ensure that the roles, responsibilities and processes of collaboration are clearly understood, through appropriate strategies early in the course.

Summary

The initial analysis of the first iteration of the research project has yielded some interesting results. There appears to be general agreement that the applied learning principles are being enacted successfully within the program, and that the students are satisfied with their experience to date. There are indications that the collaborative activities need further consideration, both in terms of communicating the value for commencing students and also in the choice and design of strategies most likely to facilitate effective and efficient collaboration. Perhaps most significant in this early stage is the emerging evidence that indicates development of the students' expectations and capabilities over time in this regard. For example, it appears that by the third semester of study and more prolonged interactions with each other, the perceived value of collaboration with peers has increased and students look to shared activities to explore different perspectives and improve learning outcomes. This aligns well with the intention of the course to be applied and authentic in the sense that it prepares students effectively for their current or future workplace, where collaborative skills are essential and sharing of knowledge is seen as part of an effective community (Wenger, 1991).

Findings from the first iteration have resulted in some minor changes to the principles guiding course design, responding to the developing nature of the student particularly in relation to collaboration with peers. For example, in the current iteration there is more responsibility given to students in second year units to choose how and with whom they would like to collaborate, and for first semester students there has been more scaffolding provided for contributions to the discussion board. This process of modification will continue throughout the three iterations with progressive dissemination of results, in order to seek feedback from both the participants and the wider educational community. It is hoped to complete this study in late 2014, in order to be able to then offer a tested set of principles to designers seeking an applied learning approach within teacher-education courses, or more broadly in higher education.

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Getting the full picture: Storyboarding our way to Stand Alone Moodle

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The process of storyboarding has long been used in the cinematic industry for scoping out, through sketches and illustrations, the sequence of narrative activities for film production. More recently, storyboarding has been used for user experience design, multimedia prototyping and mobile app development. This paper describes how researchers in a project team used storyboarding as part of a User-Centred Software Engineering (UCSE) approach to determine stakeholders' needs when designing an internet-independent version of Moodle. Storyboarding proved to be an effective way to capture a wide range of functionality requirements and align project outcome perspectives for the 'ideal product'. Most importantly, the storyboarding process enabled early detection of knowledge gaps and skillsets so that strategies could be devised to bridge the gaps. This paper will outline the storyboarding process, the gaps unearthed and the strategies employed to overcome identified skills and knowledge shortages.

Keywords: storyboarding, technology, learning, digital, project management

Background

In December 2012, the University of Southern Queensland (USQ) was awarded $217,000 by the Australian Government's Office for Learning and Teaching (OLT) to develop a stand-alone version of Moodle for use by students with no access to the internet. Funding would be used to develop automation processes and modify existing Moodle software for Stand Alone Moodle (SAM). The aim of the project is to develop SAM so that it can be deployed effectively over a number of sites and for a number of courses, providing students without internet access with an equivalent learning experience to those able to study online. Varying perceptions of how SAM would function from the diverse range of stakeholders created early challenges for the project team. In order for the project to deliver high quality outcomes, there needed to be an early and accurate identification of stakeholder interests, critical success indicators and business requirements. Articulating business requirements and defining technical functionality was complicated by a university project environment with a solutions-focused culture. Furthermore, as an externally funded project, there were substantial time and budget constraints creating additional pressure on the need to devise a strategy for prioritising features of this new version of Moodle.

Overview of storyboarding

The concept of storyboarding has its origins in the film industry where the process has been used effectively over many years to depict the sequence of narrative activities in a film or television episode. Renowned film-maker Alfred Hitchcock used storyboarding extensively for his films including the infamous 1963 movie *The Birds*. The storyboard was invented to support filmmakers when communicating with each other and their crew members about moving compositions (Goldman, Curless et al. 2006). The Advanced Computing Center for the Arts and Design at the Ohio State University describes storyboarding as “telling a story of an animation panel by panel, kind of like a comic book”. Storyboarding is useful as it allows for a more complete picture of people’s interactions, either with each other or with a software product or object, over time. Each frame represents a particular event (Greenberg, Carpendale et al. 2012).

More recently, the process of storyboarding has been used in software design processes and agile user stories where sketches are accompanied by narration to provide context (Crothers 2011). Narrative storyboards are very similar to the cinematographic storyboards used in planning movies, but applied to interaction design (Vertelney 1989). White (2013) lists three primary benefits of storyboarding:

1. Using storyboards allows the designer to quickly and easily add real-world contexts that involve place, people, and other potentially informative ambient artifacts. The storyboarding process can reveal unexpected things, and embedding that context into a design effort helps to keep the designing process grounded in the reality of the users’ lives;
2. Since software almost inevitably involves a user interface (UI), storyboards allow designers to situate UIs in the real-world contexts in which they’ll frequently be encountered; and
3. Storyboarding helps enforce a discipline of thinking in terms of experiential flow. The use of storyboards is one way to help keep a designer’s mind on the flow of activities within a greater context, and reduce issues that may occur if the UI is designed as an isolated artifact.

In addition, Rutter (2011) promotes storyboarding as an effective tool in mobile app development. Mapping the flow of screens is an effective way to make sure members of the development team have the same basic vision of the app and its goals. Changes identified during the storyboarding stage are much easier to make – by ‘grabbing an eraser’ – before the design and development process has progressed too far (Rutter 2011).

Storyboarding and how we did it

Early attempts to define business requirements for the Stand Alone Moodle (SAM) project generated a multitude of extensive and complicated diagrams. Each member of the project team differed in his or her understanding of how the end-product would function. Group brainstorming was considered as one option but was dismissed due to its focus on generating ideas for consideration, rather than rationalizing existing perspectives (Wilson 2006). The project team decided to investigate alternative ways of capturing information about participants, actions, locations, work flows and interactions. One of the team members recalled that storyboarding had been highlighted during a conference he had attended in the United Kingdom as an effective tool in mobile app development. The project team was enthusiastic to trial the technique given the funded project’s focus on digital technology.

The first step was locating a storyboard template that could capture the sketches and narrative. A quick search of the internet revealed a multitude of templates ranging from blank templates to populated film storyboards to computer-generated screenshots. The project team selected a simple six-image-per-page blank template with space for annotations to provide context. The next task was to identify someone who could prepare the sketches for the storyboards.

> Storyboards are typically rendered by hand using pencil or charcoal. These are often rendered quickly without significant detail, texture, or shading. Often the dominant subject is rendered in the most detail, with static background objects rendered more loosely (Goldman, 2006).

Fortunately, one member of the project team was reasonably skilled in sketching and was nominated to prepare the storyboard sketches. A series of meetings of key stakeholders was scheduled for the next two weeks to facilitate the narrative storyboarding process. Storyboards were created to detail the process from the moment a course leader finalized a course in Moodle, to the student using the new version of SAM software, to the course leader closing a course at the end of a semester.

Prior to the first meeting, the nominated project team illustrator developed caricatures of the three most significant people who would interact with the SAM software. This would enable easy identification of key personnel and facilitate the sketching process. During the storyboarding meetings, project team members and key stakeholders verbalized the process flows for SAM – finalizing course content, uploading course content, enrolling students, deploying SAM, and so on. Many questions were asked and assumptions were challenged. The illustrator captured each person interacting with SAM in a series of sketches showing equipment, location and context. In some areas, the team were unsure as to the best way a process could be approached so alternative storyboards were prepared to make alternative processes explicit, and in that way determine the preferred approach.

Figure 1: Storyboard for Stand Alone Moodle

Stanford University's Academic Computing Services (n.d.) warned that early in the storyboarding process there are likely to be gaps in the story that need to be further expanded. Persevering with the process would ensure that the project – whether it be a feature film or a PowerPoint presentation – would stay on track. This proved to be the case with the SAM project team: the most valuable outcome of the storyboarding process was identifying inconsistences in perceptions about how the software would function, and identifying misalignment of expectations. It also highlighted the assumptions the project team were making about university administration of student grades, identification of students and a number of other administrative matters. Once these assumptions were identified, the project team could seek the correct answers and fathom the university processes already in place with which the deployment of Stand Alone Moodle would have to align. A failure to identify and accommodate these assumptions would have significantly impacted on the deployment and administration of Stand Alone Moodle.

For the SAM project team, storyboarding proved to be an effective and enlightening process for identifying business requirements for software development. Storyboarding streamlined the complex process of isolating activities and dependencies. In the words of Little (2013), 'stories are an effective and inexpensive way to capture, relate and explore experiences in the design process.'

Alternative approaches to storyboarding

Storyboarding has been used extensively by a range of companies across a number of industries over recent years. Storyboarding's cross disciplinary application (Catchmedia, 2011), visual appeal and its potential for exploring issues and synthesizing perceptions, will ensure the process continues to be adopted and utilized for technological applications. Though the SAM project team started with a pen and paper, it can be facilitated with software such as Xcode (To 2013). Software that has been specifically developed for the purpose can take rudimentary sketches to higher fidelity designs without losing the real-world contexts that storyboards provide (White, 2013). A range of software products has been specifically developed for the purpose of digital storyboarding (O'Rourke 2009). These products facilitate 'paperless storyboarding' by providing libraries of characters, objects and backgrounds that can be placed in frames and panels. Common functions (copy, move, zoom, export, print, and so on) enable storyboard frames and panels to be prepared and shared efficiently in terms of time and cost. The project team would probably use one of these software packages in the future to ensure consistency between representations of characters, environments and so on. It is also anticipated there would be a significant saving in terms of time.

Conclusion

The storyboarding process used by researchers at the Australian Digital Futures Institute facilitated identification of the activities, sequences and interactions of Stand Alone Moodle within the OLT-funded project, 'From Access to Success: Improving the Higher Education Learning Experience for Students without Internet Access'. The visually appealing nature of storyboarding stimulated discussion amongst the project team and facilitated alignment of functionality perspectives. Storyboarding was used because of its ability to transcend disciplinary boundaries because of its highly visual nature, and to ensure that team members shared a common understanding of processes and challenges. Using sketches to map out the people, processes and technology enabled the project team to develop accurate and timely business requirements to support product development.

Storyboarding offers a number of potential benefits in the project planning stages, particularly when business and technical requirements are not being well-articulated. Firstly, it can be introduced in the early stages of a project and act as document to refer back to during the software development processes. Secondly, the process is low cost, requiring teams to give over a couple of hours of their time and make use of pen and paper. Additionally, the creative energies of the team can be captured and exploited during this process, resulting in enthusiastic discussion and group flow experience (Csikszentmihalyi 2008) with ideas being expressed and problems quickly identified including gaps in knowledge.

In terms of evaluating the effectiveness of storyboarding as part of a project planning process, further work needs to be done. Informally the team felt that it was a useful experience and agreed that they would use it again. However, it is only small part of the project planning process and should not be seen as a replacement for using established project management techniques but as an additional tool. The Australian Digital Futures Institute plans to apply the storyboarding technique within future projects and undertake a formal evaluation of storyboarding as a tool for scoping digital technology research initiatives.

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Flipped classroom in first year management accounting unit – a case study

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A flipped classroom is one form of blended learning. The blended delivery model adopted in this case study uses online content delivery mechanisms for both curriculum and evaluation. This approach allows students to better utilise face-to-face class time to have in-depth discussions with teaching staff on application of knowledge. This cast study describes the experience of both students and staff in relation to this major redesign as well as provides some reflective commentary in relation to the pilot. The pilot described in this paper relates to a first year management accounting unit. This paper will describe the process of unit redesign and implementation, including planning tools developed for teaching staff and students. The case study also reveals that student readiness and self-management skills perhaps are one of the most important elements that result in a successful student blended learning experience.

Keywords: blended learning, flipped classroom, student readiness, accounting education

Background

The University of Western Sydney in 2012 launched a three year learning and teaching enhancement project. The project aims to fuel the growth in the use of appropriate information and communication technologies (ICTs) in the delivery of learning and teaching to meet the needs of an ever increasing technological dependent student population. This project objective is to improve the student's learning experience and implement curriculum change, introduce flexibility in study regimes and overall incorporate innovation resulting in educational excellence.

In response to the University's initiative, a first year management accounting unit in the School of Business was selected to pilot a blended learning delivery approach .A review of the literature would suggest that, blended learning is a loosely defined term by scholars, which essentially refers to the integration of both classroom and online delivery methods (Partridge, Ponting and McCay, 2011). In the unit chosen for this pilot made use of a flipped classroom, for both delivery of content and assessment. In a 'flipped' classroom, students acquire content knowledge online by watching mini-lecture series and completing learning activities, and then come to face-to-face sessions to apply what they have learned in class (Bergmann and Sams, 2012). The pilot sought to evaluate whether a flipped classroom teaching strategy would achieve desired learning outcomes teaching models in a better way, which focus on both in a better way than the traditional teaching models used in this unit to date. It was thought that a blended approach might improve both knowledge acquisition and application of the curriculum. The blended learning model also seeks to provide students more control and flexibility over their learning and, at the same time, respond to the growing pressures resulting from increasing student enrolments and class sizes.

Design

The pilot first year management accounting unit previously adopted a didactic teaching method, which was offered in the traditional lecture-tutorial mode. All teaching activities were done face-to-face. In the new design, the content topics covered remain very similar to the previous taught curriculum however delivery was drastically different. The changes have been summarised in Table 1.

Table 1: Curriculum changes in the selected first year management accounting unit

	Previous version (traditional teaching method)	New version (flipped classroom teaching method)
Teaching activities	Two hour face-to-face lecture Two hour face-to-face tutorial	One-hour equivalent online learning module One hour face to face demonstration workshop Two hour face-to-face tutorial
Assessments	10% Homework (paper-based) 10% In-class test (paper-based) 25% Mid-term exam (paper-based) 55% Final exam (paper-based)	10% Online homework (students are required to achieve a minimum score of 70% in 8/10 sessions) 15% unseen questions (paper-based; handed out and marked in tutorials) 25% Mid-term exam (online exam; administered in computer lab) 50% Final exam (paper-based)
Feedback	In class; paper-based	Instant and personalised online feedback; in class; paper-based

To design a one-hour equivalent online learning module for each teaching session, a topic planner was used as a tool. The topic planner helped the lecturer to break a traditional lecture into several discrete modules with a variety of learning activities within each. These activities included recorded lecture content videos, external learning resources, real life case studies, knowledge quizzes as well as reflective activities. The planner also required the lecturer to give estimations on how much time students were expected to spend on each task, which helped the lecturer to design and review online modules from a student's perspective.

All lecture content videos were recorded by using Echo 360 personal capture, including both screen and webcam captures. The lengths of videos were varied from 3 minutes to 10 minutes. Full learning modules were delivered via Blackboard, the Learning Management System centrally supported by the University. Extra features were enabled, including 'Marked Review' feature for each learning module, which was set as a self checking point for students to record their learning progresses.

Online homework and mid-term exam were delivered on an external platform called 'MyAccountingLab'. The platform is designed to facilitate learning and teaching activities in accounting education. MyAccountingLab offers algorithmic question banks, automatic online marking, tailored learning support and instant feedback. In this unit, students could access MyAccountingLab by following instructions post on the Blackboard site.

In order to effectively communicate with students and help students to orientate in a blended unit, a weekly learning planner was designed. The planner contained information on what tasks students were expected to complete, recommended learning order and time on task for each week. The information is shown in Table 2.

Table 2: Weekly learning planner for students

	Task	**Description**	**Form**	**Recommended time on task**
1	Reading	Weekly reading of selected chapters	Offline	45 - 60 min
2	Online learning activities	A variety of online activities which are designed to assist students in developing a further understanding of the topic	Online (Blackboard)	60 min

3	Demonstration Workshop	In-depth discussions & problem solving demonstration	Face-to-face	60 min
4	Online learning activities	Pre-selected questions from MyAccoutingLab with feedback	Online (Blackboard)	120 -180 min
5	Tutorial	Further feedback from the tutor Unseen problems	Face-to-face	120 min
		Recommended time on designed learning tasks for each week:		8 hours
		Students are also required to spend another 2 hours per week on individual learning tasks, such as, reviewing and exam preparation.		

Implementation

The newly designed unit was offered in autumn semester, 2013, which was from February to July. Prior to the beginning of the semester, training was conducted for the teaching team. The Blackboard unit site was constructed and releases to students prior to the beginning of semester .This release include detailed instructions in relation to the online delivery approach as well as the first two learning modules. A welcome emailwas sent to all students introducing the new teaching approach and informed them that more support information could be found in the 'Getting started' session on Blackboard.

In week 0, the Blackboard site was visited by more than fifty percent of enrolled students. More than twenty percent of enrolled students claimed, by toggling the 'marked review' feature, that they have completed the first learning module before the class started.

In the first tutorial class, online activities were demonstrated to students and the weekly learning planner was explicitly explained. Students were also encouraged to share their understandings on how to learn the unit with their classmates.

Three weeks into the semester, the teaching team reported a highly positive experience that students were well prepared before they came to tutorial classes. Blackboard tracking data, which showed that over eighty percent of students were actively using the learning modules, also supported the observation made by the teaching team. In the first four weeks, the content areas of the unit site attracted over 20,000 hits from over 300 students.

However, the growing momentum seemed to fade after week four. Despite the fact that the teaching team regularly communicated with students both in face-to-face sessions and in the blackboard site via Announcements, student activity in Blackboard started to decline. After a sharp drop after the mid-term exam, it gradually climbed back before the final exam. By the end of the semester, the content areas of the unit site capped 51,000 hits from 259 students.

The online mid semester exam was invigilated on campus and students received marks and feedback immediately upon submission. The overall student performance was acceptable but lower than the expectation from the teaching team. The team, then, quickly adjusted certain teaching strategies, in particular, the design of homework. The total number of questions for each week was reduced, however, more procedure questions were added. As a result, the paper based final exam indicated a positive performance shift in the cohort from pass grade to credit and distinctions.

Student experience and discussion

The teaching team has been collecting feedback from students during the semester. After the census day, there were 259 students who were officially enrolled in the unit. Most of students were keen to express their opinions of blended learning. They provided both verbal and written feedback on their learning experience.

Student experience has been summarised as below:

Overall experience

- The majority of students reported that this unit was their first blended learning experience.
- Students who were in their first semester tended to report positive learning experience while students who were in their third semester tended to report less positive learning experience.
- Students who have followed the learning planner tended to report positive learning experience while students

who didn't tended to report less positive learning experience.

Feedback and instructions

- The majority of students claimed that they have received sufficient instructions and feedback.

Time on task

- Most of students claimed that they have spent less than one-hour study time on completing online learning modules, which was less than the estimation from the teaching team
- Most of students claimed that they have spent three hours or more study time on completing MyAccountingLab activities, which was more than the estimation from the teaching team

Positive feedback from students

- Some students appreciated the richness of learning resources, learning flexibility and practical online homework with instant feedback.

Negative feedback from students

- Some students did not like the unit design because it required students to complete *too many* tasks, which were time-consuming.
- Some students would like to have traditional lectures instead of online learning modules, because they *could not concentrate* or *are easily to be distracted*.

The teaching team was not surprised by mixed student response. According to the results of action research studies on blended learning (Albrecht, 2006), it is not uncommon that the introduction of blended-learning mode receives some negative reactions from students because it requires students to take more responsibilities of their own learning. Given the fact that it was the very first blended learning unit for most of students, the teaching team did not expect that all students possess the learning maturity and readiness for blended learning, which are two of essential success factors (Stacey and Gerbic, 2008). Some negative feedback from students clearly revealed that they were not equipped with independent learning skills and effective time management skills.

Future Changes as a Result of Feedback

Further changes will be made in Spring session, 2013 and Autumn session, 2014

- Review the curriculum design of online learning modules and demonstration workshops. (To optimise content knowledge delivery to meet the needs of different learning styles)
- Review the design and assessment weightings of MyAccountingLab. (To make a better use of computer-based online activities)
- Provide 'just-in-time' instructions to students during the semester. (To improve the clarity of instructions and provide better scaffolds to students)
- Design and conduct Readiness for online learning survey. The survey will be adapted from existing instrument tools to assess factors that are associated with student perceptions of blended learning and their self-management skills (Pillay, Irving and Tones, 2007; Smith et al., 2003).

Implications

The flipped classroom experience in a first year management accounting unit has implications for blended learning development in accounting education. It explores more flexible and interactive ways to use ICTs to deliver a unit that is traditionally seen as a hands-on, technical and boring unit. Despite mixed responses from students, the teaching team is enthused by the facts that students were truly engaged in the first four weeks and the results of final exam demonstrated an encouraging student performance shift. More work will be done to investigate how to sustain student engagement in blended learning. The topic planner tool for instructors and the weekly planner tool for students were well received not only by teaching staff and students from the pilot but also by lecturers from other units. The emerging issues on assessing and addressing student readiness for blended learning require further research.

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A Good Story: The Missing Dimension of a Great Online Course

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This paper outlines a model for the incorporation of storytelling techniques in to the design of online courses. There is considerable research in to the power of digital storytelling to transform, engage and educate, yet few of the courses on the Unitec LMS incorporate storytelling techniques into their design. This model is being developed to provide a stepping-stone for lecturers to move from traditional models of content delivery to digital storytelling.

Keywords: Storytelling, Online Course Design

From Textbook Index to Tale of Intrigue: A Model for Transition

There is a considerable and expanding body of research in to the power of storytelling to enhance learning, either in a face-to-face or digital context (McDrury & Alterio, 2003, Malita & Martin, 2010, Lindgren & McDaniel, 2012, Clark, 2010, Alexander, 2011). Despite the growing evidence of the effectiveness of 'storytelling' in higher education, a review of business courses in the Unitec LMS showed very little adoption of narrative techniques of engagement in their design. While some courses contain fragments of storytelling, such as role-play, case study or short video, the vast majority of courses were organised topically, with a series of descriptive headings and a list of links to information on that content. What the student sees of this course is much like a textbook index. This similarity is not surprising given many of the courses are designed around textbooks and this structure has been transported into face-to-face teaching and then the online environment.

The model set out below is the first stage of a research project exploring the effectiveness of 'storied' courses to engage students and enhance learning. The project is based on the hypothesis that the conscious incorporation of storytelling techniques in to the design of online courses will improve engagement and learning. The model has been developed following a review of the literature in to the relationship between narrative and learning, and the adaptation of storytelling techniques used in fields such as literature, filmmaking and video gaming. The purpose of the model is to provide lecturers with a starting point for the incorporation of storytelling techniques in to their online course design. It is intended to provide a stepping-stone for understanding the relationship between story and learning and moving from a textbook index approach to digital story.

Recognising the Power of Story to Engage and Educate

"[W]e dream in narrative, daydream in narrative, remember, anticipate, hope, despair, believe, doubt, plan, revise, criticise, construct, gossip, learn, hate and love by narrative." (McDrury & Alterio, 2003, p. 31). Narrative, or story, is the primary 'sense-making' operation of the human mind (Lodge, 1990, p.41). We make coherent and meaningful the many thousands of events, ideas and occurrences we experience by unconsciously telling a story about them, drawing events together to form a plot, identifying characters and assigning causality, intention and motive to those character's actions. Anthropologists and psychologists have identified narrative as the fundamental and culturally universal mode by which humans understand themselves and the world around them (Miller & Moore, 2009). Narrative is linked to the psychological development of 'self' as it is simultaneously born out of experience and gives shape to it (Ochs & Capps, 1996, p.19). The ability to use narrative is an important milestone in child cognitive development (Bird & Reese, 2008) and interfaces society and self, creating a crucial resource for socialising emotions, attitudes and identities, developing interpersonal relationships, and constituting membership of a community (Ochs & Capps, 1996, p.19). Storytelling and learning are inextricably intertwined because the process of composing a story is also the process of meaning-making (Malita & Martin, 2010). Clark and Rossiter (2008) set out that "[e]xperience itself is pre-linguistic; it exists prior to and apart from language. We access it, reflect on it, make sense of it through languaging it, which is to say, through narrating it" (p.5). The human concept of self and experience of life is a narrative one, or as Fisher (1984) puts it to be human is to tell stories.

The literary Darwinist point of view suggests that this 'sense-making' type of storytelling evolved as a defense reaction to the expansion of human intelligence that began about 40,000 years ago (Caroll, 2005). It posits that as humans began to realise the immense complexity of the world around them, stories were used to process information and make sense of it. "By taking imaginative and orderly voyages within our minds, we gained confidence to interpret this new, vastly denser reality" (Max, 2005, p.78). Myths, legends, parables, and religious accounts from all human civilisations in time take the form of narrative. Just like today, early human beings made sense of a complicated world by creating stories to explain it, drawing together events and implying causal links between them to comprehend the often incomprehensible, cruel, uncertain or painful reality which their lives occupied. Digital storytelling can be seen as the logical progression in a long tradition, incorporating emerging technologies in to the sense-making process. Online learning occurs in an information dense environment and so it is story that, as it always has done, gives students the psychological resources to make 'meaning' out of facts and events.

Reimagining Course as Story

The story of the course will depend on its purpose and content. As Riessman (2008) reminds us, a story is always "strategic, functional, and purposeful" (p.8). The course's story could be a quest to answer a question or solve a problem, a slice of life account or a journey of discovery through foreign ideas or lands, a story of conflict between groups, internal philosophical or moral conflict or a historical or biographical account. Ideally, the transition from 'lecturer' to storyteller should not be a great conceptual leap. As story is the primary mode of human understanding it is likely that, either consciously or unconsciously, the lecturer has already created for themselves the 'story' of that content. Narrative theorists talk about the inherent mental tendency of humans to put the events in their lives together in story form as 'enplotment' (Goldie, 2012). A lecturer, over the course of their scholarship, will have experienced literally hundreds of thousands of events, interactions and occurrences which they must first remember and then make sense of. Few academics, if any, recall all information in their discipline in accurate lists of facts, dates and complete scholarly works. No matter how scientific an academic's approach, as humans, we unconsciously select plot elements and string ideas and events together, creating the connections and relationships between them, or as Ricouer (1984) puts it we extract "a configuration from a succession" (p.66). As Kundera reminds us: "We immediately transform the present moment in to its abstraction. We need only to recount an episode we experienced a few hours ago: the dialogue contracts to a brief summary, the setting to a few general features…Remembering is not the negative of forgetting. Remembering is a form of forgetting" (p.128). What a lecturer will experience of their discipline as 'meaningful' or important depends as much on their subjective story of self and their lived experiences. The lecturer's sense-making story of the content they teach informs the course they design and the information they choose to present. The primacy of 'scientific' modes of understanding and communication over the subjective or narrative is a fictional product of the enlightenment era. Storytelling is not a lesser form of understanding or communicating knowledge to students, only a more conscious one. The first stage of this model is to help the lecturer become conscious of their role as storyteller in their course and to want to employ more sophisticated techniques of doing so.

Although there are many definitions of what a story can be, Simmons (2007) sets out a working definition that "[a] story is a reimagined experience narrated with enough detail and feeling to cause your listeners imaginations to experience it as real" (p.19). The classical story structure was identified in the 1800s by German novelist Gustav Freytag. A story contains an 'exposition' or starting point where the characters, setting, plot and key conflict is introduced, then moves in to 'a rising action' where suspense is built before it reaches a climax such as a turning point or main conflict. Following this, the story ties up loose ends in 'the falling action' before reaching final resolution. This model is deeply engrained in the psyche through movies, television, books and songs. New Zealand child psychologists have shown that by school-age, children are telling personal narratives using this classic high-point structure (Miller & Moore, 2009, p.436). This is because it is through this pattern of narrative that parents and teachers teach children about themselves and the world around them. Lecturers live in what Sarbin (1993) refers to as a "story- shaped world" populated by folklore, myth, popular culture, social scripts, religious traditions and parables, discourses, history and literature (p. 63). There are a great many resources on which a lecturer can draw to create a story.

Characters and Plot

The characters and plot points will be determined by the content and the purpose of the course. In deciding on the 'characters' for the story, the starting point is to consider the experience the students will have of the story. It is a well-worn cliché that 'experience is the best teacher.' As highlighted by the research, the most meaningful learning is through a student telling the story of their own lived experience (McDrury & Alterio, 2003). This is not, however always feasible or appropriate for some disciplines. "The best we can do [then] is bring the experience to them through a story that is so vivid, it feels as if they are actually there." (Simmons, 2007, p. 20). Where students cannot play an active role as the lead character of their own story, consider setting the story from a particular 'real' character's perspective so the students are able to 'experience' the events in the context of that character. In a practical, vocational or skills acquisition course consider creating a character who is in the role the students would occupy following the course. For example, in an accounting course the character may be the junior accountant starting their first job. The details of the course are learnt through the simulated interactions a student then has with others (e.g. the tax department, professional bodies, senior accountants etc) through the experience of being that character. There may be different characters which students can relate to, analyse and consider the perspectives of. The way the 'characters' experience the core plot points can also inform meaningful assessments designed to give the student the ability to advance the story.

A Captivating Opening Line

"Engagement can be understood as a kind of mystery; a story, in whatever medium it exists, elicits an audience's curiosity and makes us want to experience more of it." (Alexander, 2012, p.9). In the same way that the opening scenes of a novel or movie do, an online course should draw the student in to the question, problem or mystery at the heart of the course. The designer of an online course needs to be conscious of the student's first experience of that course and consider the impact of its 'opening line' be it through text, video or image. Consider for example, the following great opening lines:

- "The last man on Earth sat alone in a room. There was a knock on the door." (Frederick Brown, *Knock* 1948)
- "It was a bright cold day in April, and the clocks were striking thirteen." (George Orwell, *Nineteen Eighty-Four*, 1949).

The audience is immediately presented with a mystery they want to see the resolution of.

Building the Story

Once a course has the student's attention it is necessary to hold it. As set out by Alexander (2012) "some kind of struggle or problem, some source of friction, is usually required to generate both engagement and meaning." (p.13). Much like a bad movie fails to engage when the plot becomes dull, so to, an online course without any mental exercise will struggle to retain the attention of students. The mystery or conflict at the heart of the course does not have to be of Hollywood blockbuster proportions, but should be enough to engage the interest. A 'conflict' could be internal or external to the characters, for example a conflict of self (e.g. thought or morals), a conflict between different groups of people (e.g. groups in society or groups of theorists), it could be a conflict of a person against society (e.g. for government reform, justice, or improving public awareness), technology or nature (e.g. the quest to solve a technical or environmental problem). The events in the story go to answering the key question or resolving the mystery posed at the start of the course.

A brief review of the e-learning literature reveals numerous electronic resources, images, applications, videos, forums, games, case studies and role-plays that can be employed in the creation of the story of the course. However, one of the temptations for lecturers given the abundance of such resources is to "overstuff" their Moodle sites with excessive web links, unrelated videos and other distractions. Too much content creates an information swamp the students must wade around in to find a plot. Having a clear story for the course requires lecturers to be selective in the resources provided and to think about how these resources build the story in the student's mind. It may be helpful to use the 'storyboarding technique' employed by screenwriters to plan out what the student will do/see/hear/read at each stage of the story, making decisions about what should be revealed and when. Although it may sound contrary to the information sharing principles of Web 2.0, when designing an online course consider concealing part of the story, or revealing it slowly in stages, so the students want to find out the details, or better yet, need to contribute the details themselves.

Lindgren and McDaniel (2012) did a research project incorporating the elements of a platform computer game, where students had to perform certain tasks to attain the required knowledge to open the next level. This 'finding the key' approach may also lend itself to designing assessments required to advance a story. Simmons (2007) reminds us that in storytelling "[m]eaning is more important than facts" (p.16). Rather than be swamped by an excess of factual information, students grow to care about the limited facts presented because those details matter to the story unfolding. By marshalling the content in this way, facts have greater meaning and significance, and the students need to 'finish' the course to get their question answered and achieve a sense of resolution.

The Ending

The designer of an online course must be conscious of how the student experiences the end of the course. The course designer may want to leave the students with a sense of resolution and achievement, tying up all loose ends, or by posing a further question or a call to action in response to a problem. The lecturer does not need to be the sole author of the story in the course. The students can play a role in the creation of the story, how it progresses and how it ends. It may be possible to create multiple endings that student's choices influence.

Next Steps: Implementing and Evaluating the Model

The first stage of this project was to review the literature on the relationship between narrative and learning and identify transferable storytelling techniques. From that review a model to help lecturers move from the 'textbook index' approach to course design to a digital storytelling approach was developed. The next steps are to 'trial the method' and prepare case studies of how this model can be applied to online courses (mid to late 2013). Following on from this, the model will be used with a group of Unitec lecturing staff who will be creating online courses and making the transition from face-to-face/blended learning to the online delivery of courses (early 2014). During this process, the experiences of staff in implementing the model and students in engaging with storied courses will be evaluated.

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A new era; Personal Technology Challenges Educational Technology

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As we race towards a new era, rapid change of conventional models has become the norm. Just as technology has etched itself to the core of society, the sheer quantity of student devices connecting to university networks presents a sector wide challenge coinciding almost perfectly with many universities creating technology rich learning spaces. New fears include future proofing. It is not just a matter of technology becoming outdated. In seeking to accommodate the teaching styles and experience of staff across diverse faculties, is this technology simply too vanilla to meet their needs as they become increasingly skilled and inspired by technology's potential? Through the early findings of a study into staff use of technology within Queensland University of Technology's next generation collaborative learning spaces, this paper explores whether the answers lie in a model presented by students equipping themselves with the tools they need to learn in the 21st century.

Keywords: Technology, learning, higher education, future proofing, collaborative learning, learning spaces.

The Digital Future

Visions of a digital future more often than not play out in science fiction before becoming our reality. Advances in technology are seemingly limited only by our imagination. The pace of acceleration in technological development approaches light speed. When computer systems once required whole rooms, the need for personal computers would have been incomprehensible. Yet by the 1990s mobile computing became fact. The computing landscape subsequent exploded with smart phones and tablets now be found in the pockets and backpacks of students across the globe. In just a few short years mobile technology has become ubiquitous and presents itself as the silent revolution in higher education. Smart devices now outnumber global population (ITU, 2013, 1). As the intelligence of these devices matures, predicting our processes as we interact, so too will their entanglement in our everyday lives. Where does the future lie for higher education?

Sector wide, concerns are shifting from access and availability of technology to the sheer quantity of student devices connecting to university networks. University investment in new learning spaces is considerable, yet these spaces are routinely equipped with vanilla technology. Pace of technological advancement presents a constant pressure upon ensuring technology is not outdated before its installation. The economics of servicing large fleets of computers within learning spaces is influential in making cost effective, uninspiring technological solutions. Pressures upon choice include the capacity of the technology to meet the needs of teaching staff across a range of faculties with various teaching styles and skill sets in teaching with technology. Designers and architects of these spaces are confronted by how to cope with the changing needs of teaching staff as they become increasingly proficient and inspired by technology's potential in their teaching.

Early adopters of technology among teaching staff appear to be following the lead of students and bringing their own devices while waiting for institutional catch-up. This presents a potential institutional solution. Employee BYOD is not a new phenomenon in other sectors. Like the preferred knives of a chef, or the scissors of a hair stylist, should higher education adopt the model used in industries where employees are supported in equipping themselves with the tools of their trade? The answer to sustainability may be that institutions take the lead in providing learning spaces that are inviting, conducive to a range of learning experiences and facilitate the use of a multitude of technologies, which may be brought into the space by academic teaching staff and students. In such a vision of the future it would be imperative that institutions assume responsibility for supporting and encouraging, financially and otherwise, academic staff who wish to equip themselves with tools to teach in 21st century learning spaces. Institutional equity initiatives, particularly in relation to access and affordability, must address the needs of both staff and students. The economics of such a model include the likelihood of staff and students renewing their technological choices more often than would be financially feasible were the mobile devices owned by the university.

In Space

The pace of student adoption of technology is eclipsed only by the forms in which they have seen fit to mould personally owned devices into their learning experience (Conole, G., de Laat, M., Dillon, T., & Darby, J., 2008). Students are actively demonstrating the affordance of using one's own technology. This testifies to their perception of the benefits of equipping themselves with the tools to learn in the 21st century. Just a few years ago, we were concerned that not all our students might have a mobile device on hand in our classrooms (Evans and Matthew, 2012). The potential for a paradigm shift in staff and institutional use of technology remains largely untapped and yet is a pressing concern in creating sustainable, technologically rich, learning spaces.

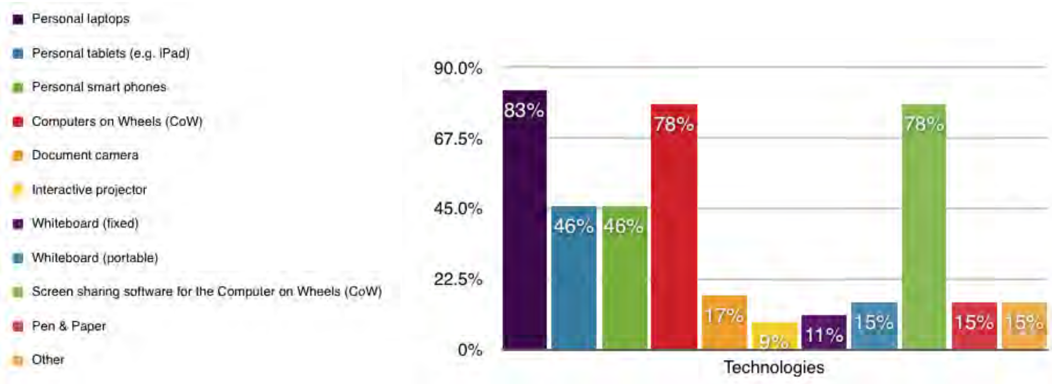
As we identify challenges between personal technologies and educational technologies, trends are emerging from the work undertaken by Queensland University of Technology in the use of the new collaborative learning spaces and the design of a new $230 million Science and Engineering Centre opened in 2013. The design of these new learning spaces draws on research and practice in both problem based learning (PBL) (Hmelo-Silver, C. E, 2004) and collaborative learning (Lee, C. D., & Smagorinsky, P, 2000). Experimental collaborative space design and the study of the experience of early adopters within those spaces were underpinned by a university-funded project called, Learning and Teaching in Collaborative Environment (LATICE) with four key objectives:

- Developing a strategy to integrate a range of scalable, transformative and sustainable models for learning and teaching in new physical and virtual spaces, strategically aligning with university initiatives.
- Assisting academics to design, develop, and implement new pedagogies that utilise more flexible interactive and collaborative learning space.
- Ensuring provision of support for appropriate collaborative technologies to facilitate collaborative learning and teaching models for in class physical and virtual collaboration/communication.
- University sector and inter-faculty collaboration, advancing research and evaluation of new learning environments focused on pedagogy, space and technology.

Building the aspirations of teaching staff was central to the adoption of these new learning spaces and as part of the LATICE project. Specialist staff development programs were created that focused on student centered approaches for active and connected learning (Penuel, B., Rhodes, J., Salen, K., Schor, J., & Sefton-Green, J. 2013).) The key aim of these programs was to inspire teaching staff with new ideas and approaches to engaging students in rich, real world learning experiences that harness the physical space and their technology while encouraging best practice implementation of emerging pedagogical practices. Evaluation of these spaces has included detailed surveys of both staff and student experiences of learning and teaching, interviews, observational data and business analytics examining the impact on attrition of classes taught in the new spaces.

The purpose of the evaluation was for the evaluation and improvement of learning and teaching. It was undertaken in accordance with university ethics procedures. The data examined in this paper is part of a broader evaluation process and should be considered within this context. Academics teaching in collaborative spaces were invited to undertake an online survey. The survey was designed to provide a meaningful insight into both the academic experience and academic perception of the student experience in collaborative spaces. 46 responses were received. The use of technology within these new learning spaces was of particular interest. Figure 1 displays staff responses to the survey question 'what technology do you typically use in class'.

Respondents were able to select more than one technology in response. Results for each possible result are displayed out of 100%, allowing scrutiny of each technology and its use by the survey respondents.



Which technologies do you typically use in class? (you may tick more than one)

Figure 1: Survey Results

Preliminary analysis of these survey results show over 82% of staff indicated that they were using the university provided computer in the new collaborative learning spaces in contrast with 19% using tablets and 26% using a laptop. A significant number of respondents rely upon and use the university provided technology but a number are bringing their own technology. When correlated to the growth of staff mobile devices seeking to connect to QUT wireless networks, these results appear consistent with social trends generally in staff BYOD: it appears that we are witnessing an increase in the phenomenon of staff bringing their personally owned devices into their teaching and learning environments. While institutions continue to grapple with data security implicit in staff BYOD, there may be a serendipitous efficient benefit that may go some way to addressing institutional concerns regarding sustainability of technology rich learning spaces.

The collaborative learning spaces are designed for multiple groups of 6-8 students, each group equipped with a Computers on Wheels (COWs), whiteboards, keyboards, web access, large tables, comfortable chairs, the latter two all on wheels. QUT's collaborative learning spaces employ herds of COWs, a trolley-mounted computer with a large plasma screen, designed specifically for student collaboration.

Considering the traditional use of technologies in learning spaces, we may have expected to see both a resistance to engagement with new technologies and persistent continuance with familiar technologies. Reluctance to engage with new technologies is likely to be at its highest where pedagogically sound use of new technology involves a deeper understanding of learning. While this was expected, it did not prove to be the case with this data set:

- Survey responses indicated that COWs were used by 41% of staff. Interestingly, COWs are designed for student use. COWs are not specifically designed for staff use.
- Real time collaboration tools played a central role in the staff development programs. More than 15% of respondents indicated that they used real time collaboration tools like google documents within their teaching, thus establishing a connection between academic staff development programs and adoption of technology.
- 43% of survey responses reported using a whiteboard but interestingly 34% made use of the document camera, which many regard as the future whiteboard.
- 15% of respondents indicated that they were using interactive projector technology compared to 82% using the built in computer. This trend in results suggests that the need for using projector technology was, to some extent displaced by screen sharing software used by 26% of respondents.

In Time

Academic adoption of technology in teaching is consistent with pedagogy targeting increased student engagement. Though it is not proposed here that the technological cart be put before the horse, more and more often technology provides new pathways for achievement of learning and teaching objectives (Palfrey & Gasser, 2008; Oblinger, 2005). Oliver and Goerke framed the 'enterprising university teacher' as one who harnesses students' social use of mobile devices and social software applications and challenges students by encouraging them to become participative constructors of knowledge in engaging learning experiences (Oliver and Georke, 182-183). Such a construct enables a richer, 'real world', learning experience where students are 'encouraged and enabled to engage repeatedly in the goal - action - feedback - reflection - adaption - revision cycle' (Laurillard, 2009, 14). The teacher is able to 'motivate the iterative exchange of ideas' and students 'have an increased sense of ownership of the whole' learning experience since 'their own contributions clearly playing a role in the synthesis of ideas' (Laurillard, 2009, 14). Active learning research suggests outcomes improve when students are actively involved in thinking about what they (Braxton, Milem & Sullivan, 2000; Popkess and McDaniel, 89). Numerous projects harnessing in-class use of students' own mobile devices demonstrate that the power of mobile technology at the fingertips of students can be exploited in effective learning design alleviating institutional burden of investment in technology such as commercial clicker systems (Stav, Nielson, Hansen-Nygard & Thorseth, 2010, 179; Evans & Matthew, 2011).

What is evident in the trends emerging from the data is that traditional approaches to space, technology and pedagogy are shifting. Questions for further research include whether early adoption of technology by students is influencing pedagogy. It may be that staff adoption of technology in teaching is more likely to be explained as a cultural response to changes in society rather than an effort to seek new ways to engage students in learning. Trends emerging from this research suggest staff are following in the footsteps of our students as intrepid explorers of new learning spaces, and present an interesting insight into what the future might hold.

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Action-based Learning Assessment Method (ALAM) in Virtual Training Environments

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Specialised and high priced simulators for surgical training, chemical labs, and flight training can provide real-world simulation in a safe and risk-free environment, but they are not accessible for the broader community due to costs for technology and availability of experts. Thus, training scenarios shifted to virtual worlds providing access for everyone interested in acquiring skills and knowledge at educational or professional institutions. Even in this context, we still expect a detailed formative feedback as would have been provided by a human trainer during the face to face process. Whilst the literature is focusing on goal-oriented assessment, it neglects the performed actions. In this paper, we present the Action-based Learning Assessment Method (ALAM) that analyses the action-sequences of the learners according to reference solutions by experts and automated formative feedback.

Keywords: Action-based Learning Assessment, Virtual Training Environments, Formative Feedback

Introduction

The effectiveness of learning and teaching depends on various attributes; most relevant are the context and surrounding in which the learning occurs. Literature studies and classroom lectures are effective ways to generate theoretical knowledge, but are insufficient for acquiring experience about the application of knowledge in real-world scenarios (Kolb & Kolb, 2012). For example, we would most likely trust a historian to research accurate information about historical events from ancient books, but would feel quite uncomfortable to participate in the very first flight of a pilot trained just with books about how to fly. We approve a skillset by conducting either real-world or advanced simulator training; the latter one transferring and simulating all relevant factors within an artificial (virtual) environment. Therefore, creating an authentic learning environment could be seen as one of the most salient challenges in educational research, resulting in a continuous development of new models, frameworks and technologies for an immersive learning experience.

Real world experiences are challenging to replicate in a purely virtual learning environment and generally require the well balanced combination of technology, domain expert knowledge, and developers knowing how to build authentic virtual environments. The need for the virtual environment can be justified with various arguments depicting the infeasibility of scenarios for real world training; i.e., high costs (e.g., aircraft pilot training), high risks of injuries for learners and educators (e.g., hazardous chemicals), or impossibility (e.g., deep space rocket missions or natural disaster recovery). Flight simulations are commonly known to train standard as well as emergency procedures using a cockpit simulation. Detailed replicas achieve authenticity, projection of real-world images on the cockpit window and a pneumatic system for movements create a high degree of immersion for the learner.

The advent of powerful computational devices, 2D/3D displays, human-computer interface technologies, and associated algorithms to process the vast amount of information in real-time has given impetus to further, specialised as well generalised environments (Reiners et al., under review). There are virtual training environments to train students in particular disciplines; e.g., surgery, mechanical engineering, and other domains (Filigenzi et al., 2000; Kizil, 2003; Gunn, 2006; Hockemeyer et al., 2009). The virtual training environment is used to recreate the "real world" in as much detail and authentically as possible. Virtual training environments create a sense of reality for learners, often represented by an avatar, to support the immersion in such a way that simulation "feels" real for the duration of the training; i.e., to engage the learner and promote intrinsic motivation. There are many advances being achieved in terms of automating these environments; e.g. by substituting the human actor for the simulation with so called non-player characters (NPC), bots, and intelligent environments (Wood & Reiners, 2013). It provides learners with independence as they do not rely on others for the learning session (with respect to timing, capacity and qualification), can choose to learn at any time from any location, and can repeat specific situations as long as required without 'wearing out' other stakeholders in this process.

For an effective learning outcome, it is also tremendously essential to assess the learners' activities. Despite all improvements over the last years, the learner is currently still relying on summative feedback; mainly evaluating the successful completion of a learning scenario and achieving the learning objectives; however, this highly limited perspective ignores how the learner reacted on stimuli and applied learned knowledge to make decisions during the learning process. To provide an extensive formative feedback, we cannot restrict our focus on the outcome, but include the learners' sequence of actions to deduct implications for the assessment and formative feedback (Reiners et al., forthcoming). Scholars keep pushing the boundaries to develop intelligent assessment systems that can provide a qualitative formative feedback similar to one being done by an expert human evaluator (Fardinpour & Dreher, 2012). Assessing only the outcome would also implicate that the choice and correct application of actions are irrelevant; e.g. a professional athlete who is winning medals and sets new world records. From a goal oriented perspective, this learner achieved all training and learning objectives and is capable of recalling the skills in a competition. Assume further that the athlete, despite the success, did not execute accurate training units and, therefore, caused extreme stress on the joints. Goal oriented assessment would not recognise this unless the achievements are inferior to the expectations and often after being able to counteract the damage. Another example is exams, where a goal-oriented approach evaluates the answers despite their origin. Yet, we control every action from handing out the exam questions to the final submission, even though the control is mainly about detecting misconduct like consulting an expert via phone during the exam. Overall, it is critical to look at the action sequence that leads to the outcome, either to prevent failures or cheating, but also to allow learners to explore the environment and discover unique solutions based on their experience and prior knowledge.

In this paper, we introduce a framework to assess all learners' actions in a virtual training environment with respect to the learning objectives and to create a computer-generated (formative) feedback as well as improve the self-guided repetition of key lectures, refinement of skills by comparing different training sessions, and the experimental evaluation of errors and their effects on the overall outcome. We are interested in the applied knowledge rather than the memorisation of facts being repeatedly repeated as the ultimate solution to a problem. Note that the applied knowledge equals the 'level of application' in Bloom's taxonomy (Bloom et al., 1956). We continue with a review of relevant literature and introduce the terminology for the *Action-based Learning Assessment Method* (ALAM). Here, we restrict ourselves on a formal description of the method to outline ALAM and its application within *virtual training environments*. We should note that we focus on these environments, but intend to generalise our approach for other virtual environments. We conclude the paper with an outlook on future research.

Background

In this section, we introduce the used terminology to achieve a common understanding. For this reason, we discuss virtual environments in education and action-based learning, and the relevance as well as challenge of providing formative assessment. Here, we restrict ourselves to virtual learning environments and demonstrate the incorporation of formative assessment to improve the learning process. Note that this section does not intend to provide a complete literature review, but argues the need and motivation for our framework and how it can contribute to the field of education.

Virtual Environments in Education

Virtual Learning Environments (VLE) are "computer-based environments that are relatively open systems, allowing interactions and encounters with other participants" and generally provides access to a wide range of resources (Wilson, 1996, p. 8). The “success” of VLE relates to the Internet as it transfers the existing technology as well as the philosophy of the Web to the educational system. Learners and teachers are able to access a learning space that contains all the required materials and information (e.g., classes, class material, assessments, or grades) but also provides communication means that are independent of time and place (discussion boards, chat). VLE become social spaces, building networks, and groups especially in a distance education context.

A special type of VLE is represented by Virtual Training Environments (VTE), such as Intelligent Pedagogical Agents (Rickel et al., 1998), Game-based Tutoring Systems (Craighead, 2008), and Educational Simulation Environments (Dede & Lewis, 1995; Dede et al., 1999). Often, VTEs are realised as a layer on top of a VLE; the VLE provides the necessary functionality to administrate and manage the course while the scenario and interface is represented in the VTE. Different industries are using VTE for their employees. In surgery training, systems are proposed such as collaborative virtual sculpting with haptic feedback (Gunn, 2006), Spinal Anaesthesia (Hockemeyer et al., 2009), the dynamic hip screw surgery training in Vitro (Ahmed et al., 2012), force feedback haptic device for oral implantology (Chen et al., 2012) and many others. In the mining industry, virtual training system applications in virtual reality for mine safety training are extensive (Filigenzi et al., 2000), and some of the VR applications developed by the SMI-VR research group (Kizil, 2003) include drill rig training simulation, open pit simulation, underground hazard identification and barring down training simulation, instron rock testing simulation, accident reconstruction, three-dimensional mining equipment, ventilation survey and real-time monitoring simulations, and virtual mining methods.

The main intention of virtual worlds was not necessarily education, but it has demonstrated the capability to take the distance out of distance education, increase engagement with online learning students, and blend the new environment with the traditional learning approaches from the classroom environment (Wood & Reiners, 2013). Twining (2009, p. 498) further points out “virtual worlds allow you to do things which would be difficult or impossible to do in the physical world – both literally and pragmatically.” Traditionally, virtual worlds provide an environment with basic functionality to build individualised scenarios. Open virtual worlds; e.g., Second Life or OpenSim, offer manifold opportunities to create or import objects; often without any restrictions on defined spaces (Bainbridge, 2007). Virtual experiences to support real-world situations have been used in education in several areas such as teacher education (Gregory et al., 2011), engineering (Bresciani et al., 2010), health sciences (Thompson & Hagstrom, 2011), logistics and manufacturing (Wriedt et al., 2008) and would be valuable in other areas, such as the simulation of hazardous situations for training purposes (Reiners & Wood, 2013).

It is fascinating to observe the shift from VLE and VTE towards virtual worlds; transforming a hard technology with massively restricted freedom on how to manage the administration of the educational task towards a soft technology with an open and unrestricted virtual (learning) space (Dron et al, 2011). Some approaches like Sloodle (Kemp & Livingstone, 2006) link the open space with Learning Management Systems (in this case Moodle) to recreate the course structure with all its elements and tools for assessment. Observing the development of VLE over the last year reveals the struggle to find the right balance of open and structure, of guidance and freedom. However, we require structures and environments like Second Life to transfer the real world into the virtual space such that learners can train in a safe environment (Jarmon et al., 2009). VTE seem to form consent and a context by providing the necessary structure and administrative tools; yet offer the learners enough freedom to explore scenarios to achieve certain learning outcomes.

In VTE and virtual worlds, learners often operate through avatars to represent themselves in the environment; either in the third person perspective showing the whole avatar or the first person perspective where the learner often sees only the arms and hands. The avatar is controlled by the learner using either traditional input devices (e.g., keyboard and mouse), advanced technology (e.g., Kinect or Razor Hydra), or even authentic tools to map the real-world haptic experience to the virtual environment. The input is translated to specific commands being executed by the avatar. The environment is often shared with other avatars; either controlled by other learners or teachers, or so-called intelligent bots or agents being controlled by the computer (Reiners et al., in press). In addition to verbal communication using (voice) chat, virtual worlds allow the learner to use gestures as further means of communication (Traum & Rickel, 2002).

Action-based Learning

Learning-by-Doing or *Action-based Learning* is a valuable methodology for educators and researchers in education, and refers to "all learning that is orchestrated by some activity on the part of learners" (Naidu & Bedgood, 2012). We adapt for the term *action* the definition used for agents in artificial intelligence, "*with action [being] an occurrence caused in a 'certain' way by the 'Avatar'*" (Allen, 1984, 138). Thus, legitimate learning actions may vary from a real participation of students (in building, creating, or drawing something) to learners watching a video clip that is later examined, reflected on, or plants a seed for a later decision making process (Naidu & Bedgood, 2012).

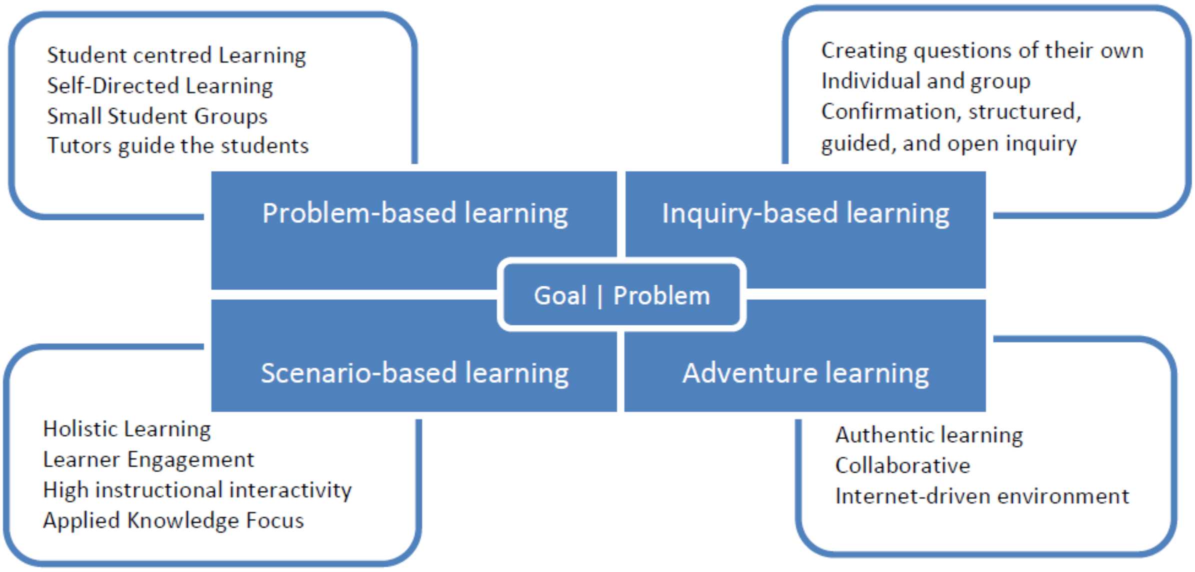

Figure 1: Different types of Action-based Learning

The literature distinguishes different models of action-based learning (see Figure 1). That is, problem-based learning (Barrows and Tamblyn, 1980), inquiry or goal-based learning (Schank, 1997), scenario-based learning (Naidu, 2010), and adventure learning (Doering, 2006). Whilst each of the different types has a distinguished focus or perspective, for all it is common to start from a defined problem or goal, which has to be achieved (Naidu, 2007). Action-based learning characterises a learner-centric model where the learner studies the learning material and then applies the *lesson learned*. This *learning by doing* approach discriminates action-based learning from action learning where learning is achieved "by using personal experience and reflection, group discussion, and analysis, trial-and-error discovery, and learning from one another" (Lasky & Tempone, 2004, p. 87). Action learning appears within a group of employees, by discussing, analysing and solving certain problems. Action-based learning is about actions, which the learner performs in the learning environment to achieve a learning outcome.

Learning Assessment in VTE

Learning assessment is about grading a student's learning outcome, which can be either tangible like a report or artwork, or intangible like skills or knowledge (Sadler, 1989). Scriven (1967) coined the main categorisation of assessing students' learning outcomes in *summative* and *formative* assessment to qualify the assessment to improve the learner (formative), or just rank the outcome in categories like pass or fail (summative). Individual explanatory feedback is one of the key elements in formative assessment and is usually about providing detailed information about the assessment and how it could be improved in the future. It is about making the learner understand, not about reporting numbers and grades (Sadler, 1989). A further differentiation is presented by Rogers (1951), where feedback is classified in evaluation (total score), interpretive (detailed score), supportive (score and guidance information), probing (score with a detailed analysis), and understanding (score and support to understand the reason for deductions). Stages 1-2 (evaluation, interpretive) are summative, and Stages 3-5 (supportive, probing, understanding) are formative. Overall, the learner relies on (formative) feedback to improve and progress in the learning process. Traditional assessment methods (e.g., multiple-choice and closed answer questions) are too restricted to cope with the flexibility, complexity, and creativity that a learner gains with action-based learning (Naidu, 2010).

The use of simulated actions as substitutes for real-world actions in the aerospace industry, especially for pilot training, is exceptionally strong evidence of the significance of learning using virtual worlds and environments. Assessment of learners' mastery in these training environments is mainly based on observation of an expert or videotaping the training and analysing it by the experts after the training session. For automation of this evaluation process, activities in the virtual space can be recorded as a continuous sequence of performed actions; keeping a history of what was done at what point of time; including the environmental information and interaction with other avatars. Actions executed in the virtual space are generally performed using commands through the avatar. For advanced formative assessment, we have to record and analyse the learning path rather than just the learning outcome. Shute et al. (2009) argue that the assessments should be "seamlessly woven into the fabric of the learning environment" so that it is virtually invisible to the learner and, therefore, causing no distraction. The so-called *stealth assessment* uses automated scoring and machine-based reasoning techniques to infer, for example, the "value of evidence-based competencies across a network of skills" (Shute et al., 2009, p. 299). Stealth assessment was formally used by Shute for the first time in 2005 during an AERA (American Educational Research Association) symposium on diagnostic assessment, but it was designed and employed two decades earlier as part of a guided-discovery world called Smithtown (Shute & Glaser, 1990; Shute, 2011). It is mainly used to assess action-choices in games for learning, but it has the potential to be improved and used in training systems as well. Al-Samadi et al. (2012) propose a framework using Stealth Assessment to assess action choices and sequences in serious games; creating formative feedback on the 'interpretive' level of Rogers' feedback classification (Rogers, 1951), in which players get a score.

The benefit of immersing learners into an authentic learning experience is well established in the literature (Hannafin & Land, 1997; Herrington et al., 2003; Yahaya, 2006). There are significant advantages for virtual training systems in which the learner is represented by an avatar. However, there is not yet a comprehensive solution on how to assess students' learning. This establishes a need for further research to design and implement an automated action-based formative assessment in virtual training environments and virtual worlds. To extend the goal-oriented assessment, where we just take a snapshot of the whole learning process and compare it to an expected outcome, to an evaluation of the process of how a learner is reaching that outcome, doing things is challenging. Especially in cases where we have some requirements on actions, but allow also for exploration of the learning space. In addition to comparing expectation and outcome, we also have to identify, classify, and evaluate the learners' actions.

Action-based Learning Assessment Method (ALAM)

Action-based Learning Assessment in VTE is focussing on assessment of goal-oriented actions and action-sequences; reflecting the learned knowledge. These goal-oriented actions include verbal and nonverbal actions, speech acts and gestures. Action choices are also as essential as actions in assessment; they are reflecting the users' learned knowledge and they are classified in 'Application' level of Bloom's taxonomy (Bloom et al., 1956). The design of Action-based Learning Assessment Method is motivated by the theoretical contributions of the educational psychologist Rogers (1951). Action-based Learning Assessment contributes to the theory, practice and public utility; enabling automated assessment of actions and learning at the highest levels of Bloom's taxonomy (Bloom et al., 1956) and demonstration of knowledge - not just the memorization and application of knowledge. The concept of Stealth Assessment (Shute, 2011) has emerged from the computerized game-playing environments where users' activities are constantly being recorded and assessed. The developed Taxonomy of Actions for Action-based Learning Assessment in Virtual Training Environments enables the recognition of relevant actions due to certain goals that have to be achieved or problems to be solved.

What is ALAM?

Action-based Learning Assessment Method (ALAM) is a formative assessment method in virtual training environments, assessing learners' goal-oriented actions and action-sequences and providing them with formative feedback. Assessment of action choices is used in educational games and virtual training systems for summative and formative assessment of memorized knowledge and in some cases application of the learnt knowledge. ALAM creates the opportunity to analyse and assess how learners do things, and not just what they do. The main difference of ALAM to other assessment methods, involving learners' activities, is that ALAM does not restrict the learner with predefined action choices like educational games do. Learners perform the full operation, and they see the consequence of their actions within the limitations of the designed system. Based on performed actions and the sequences of those actions formative feedback will be generated that describes the correctness of learner's performance, possible mistakes and best given solution.

What does ALAM assess?

The Taxonomy of Actions for Action-based Learning Assessment in Virtual Training Environments is developed to classify learners' goal-oriented actions. This taxonomy classifies trainees' actions into *The Goal Act, Constitutive Acts, and Functional Acts.*

1. *The Goal Act:* The Goal Act is the highest level of action in VTE, can be complex and/or composite, which is a specific goal to be achieved by the trainee. The Goal Act is formed of one or more Constitutive Acts; e.g., fixing the rotating shaft or doing a heart surgery.
2. *Constitutive Acts:* to achieve the Goal Act in VTE, trainees need to perform a sequence of high-level compound actions called Constitutive Acts; these high-level actions are composed of other low-level actions named Functional Acts. The objective of Constitutive Acts is to achieve the Goal Act.
3. *Functional Acts:* They are the lowest level of actions in VTE, which enables avatars to act within VTE. Objective of Functional Acts is to form Constitutive Acts. Functional Acts are classified in six action classes: Gestural, Responsive, Decisional, Operative, Constructional, and Locomotive

Functional Acts are classified as follows:
- *Gestural:* These actions are movements in the avatar's body and/or face expressing different meanings, and communicating particular messages, a variety of feelings and thoughts, from contempt and hostility to approval and affection.
- *Responsive:* These actions are responses triggered by changes in the environment or objects; like pushing the button when the green light comes on or taking your hand back after touching the hot metal.
- *Decisional:* Avatars have to reflect their decisions by choosing between different options; like choosing between left or right, up or down, yes or no, quantity, numbers, etc.
- *Operative:* Simple basic acts enabling avatars to function in VTE by executing different non-constructive actions; e.g., push, collect, grab, etc.
- *Constructional:* Simple fundamental manipulative acts allowing avatars to impact on their environment as well as its objects; e.g., cutting, screwing, etc.
- *Locomotive:* Actions empowering avatars to move around or teleport to different parts of the virtual environment to execute their tasks; such as walk, run, fly, teleport, and etc.

In ALAM, action-sequences are encoded in form of a list of single actions using the following syntax: <id><Action.Class><Action.Type>[<Action.Attribute>][<Action.Relation>], with <id> being the position in the sequence, <Action.Class> being a Functional Act, <Action.Type> being the instantiation of different actions (specific representative of the class), [<Action.Attribute>] being a list of possible attributes such as quality, quantity, and locations, and [<Action.Relation>] being a list of possible relations to other actions. Note, that ALAM also recognizes Irrelevant Actions to allow fault-free assessment and comprehensive feedback.

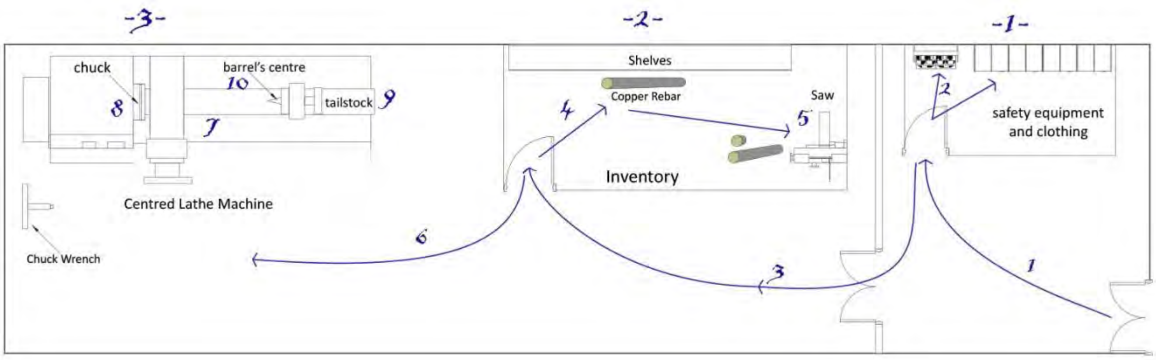

Figure 2: ALAM example scenario- Supporting copper rebar in the lathe machine chuck

The example scenario in Figure 2 shows how users perform different actions in a certain sequence in a virtual machinery shop. The Goal Act is "Supporting copper rebar in the lathe chuck" and the trainee needs to perform three Constitutive Acts successfully. To support the rebar in the lathe machine the trainee has to 1: enter the shop and collect safety equipment and clothing, 2: Choosing and sizing the cooper rebar, 3: Put the rebar in the chuck and fix the tailstock. The trainee enters (Locomotive) the virtual shop, goes to safety room (Locomotive) and collects safety equipment and clothing space (Operative); then moves to inventory room (Locomotive), chooses a copper rebar with a diameter of 0.4 inch (Decisional) and cut two pieces of rebar (Constructional) in sizes 1.5 and 0.5 inch (Decisional). While cutting the rebar, the trainee places his hand too close to the saw blade so by feeling the blade near his finger takes his hand away (Responsive) extremely fast to avoid hurting himself. The trainee moves to the machine shop (Locomotive), and opens the chuck (Operative), puts the rebar (Operative) in it and supports the rebar by turning the chuck wrench (Operative) to the right (Decisional). The trainee then pushes the tailstock (Operative) and puts the barrel's centre to the end of rebar (Operative) and tightens it (Operative). Trainee checks the rebar between the chuck and the centre by shaking it (Operative), makes sure it is tight enough (Decisional) and nods to the operator (Gestural) to turn on the lathe.

How does ALAM work?

Trainees interact with the VTE using different technological peripherals, performing a sequence of actions, to achieve a predefined goal, namely the Goal Act. The recorded data is processed to recognize actions, which are further checked for their relevance and belonging to a specific action-sequence. Then, the trainee's actions and action sequences are compared to the one recorded by experts' in terms of correctness and relevance of actions and action-sequences; based on this comparison and evaluation, formative feedback and an assessment score is generated and provided to the trainee.

ALAM uses Rogers' 5-stage feedback classification, which is still valid and commonly used in assessing students learning outcomes (Al-Samadi et al., 2012; Dunwell et al., 2011). Human markers are capable to provide feedback on all stages. Yet it is far more common to simplify (mainly concerning the workload) the process by designing multiple-choice or short answer assessment. Especially as formative feedback at Stage 4 or 5 requires expert understanding if the answer of the student is valid with respect to the scope and body of knowledge, and if not, exploring the train of thoughts that lead to the given answer. Automating Stage 1 and 2 is relatively easy and often done. The other stages have a higher complexity as it requires understanding of the problem, the context, and often natural language, tasks that cannot yet be done automatically by intelligent assessment algorithms (Shen et al., 2001). The complexity is reduced by specifying constraints to reduce the problem and solution space.

In this assessment method, ALAM, we are interested in actions and action-sequences that lead from the initial state of the environment to a final state where the problem is solved. For each change of state, we record the actions and action-sequences being executed by the learner; providing us with a complete protocol (sequence of actions representing the solution for a problem) of how the learning objectives were achieved. The learners' action-sequences are compared to the expected action-sequences recorded by experts or instructional designers. It is not essential to have a complete match, as the solution to a problem might not be unique. Both these sequences are compared by verification based on the milestones that are needed to find a solution.

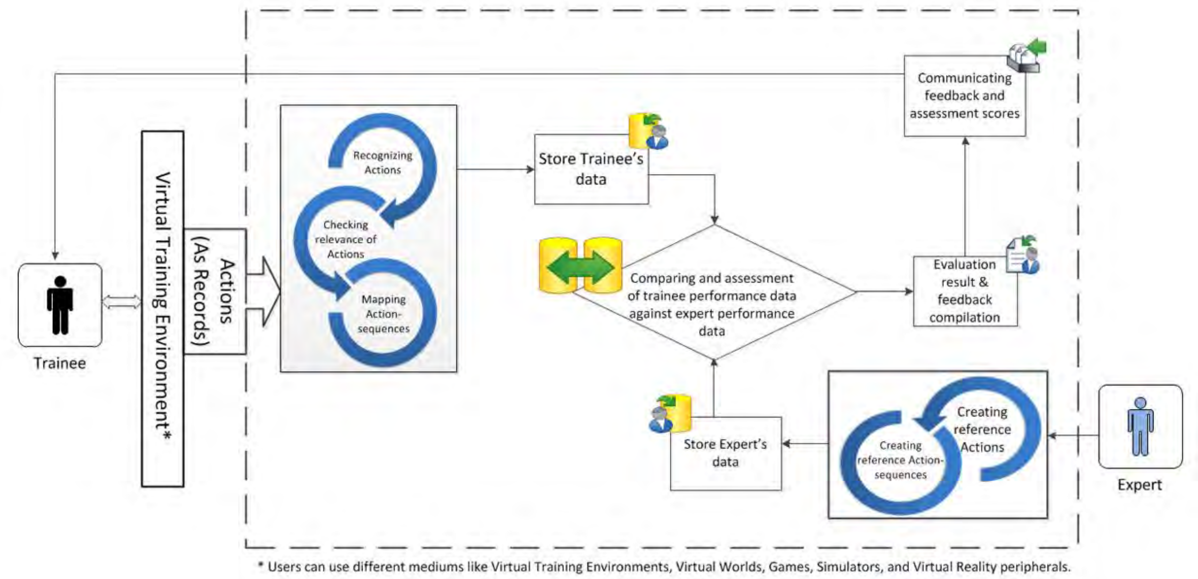

Figure 2: System design for the Action-based Learning Assessment Method (ALAM)

The learner has the opportunity to proceed from one milestone to the next without being constrained in between; yet milestones and their sequential order might be crucial. The restricted scope allows us to implement an immediate formative feedback, being triggered when the learner hits a milestone; see also Reiners et al. (2013).

The system design for ALAM includes a subsystem called Action Recognition Agent that is responsible of recognizing actions, checking the relevancy, and mapping the action-sequences. The output of this subsystem is a list of coded actions with a certain sequence, ready to be used by the Assessment Engine. As a demonstration, you can see this output for Constitutive Act 1 (enter the shop and collect safety equipment and clothing) performed by the user and its reference solution performed by an expert, in Table 1 below:

Table 1: Action Recognition Agent's output for Constitutive Act 1
(enters the shop and collect safety equipment and clothing)

User's Actions and Action-sequences	Expert's Actions and Action-sequences
<1><Locomotive><teleport>[<Enter>] <2><Operative><read>[<manual>] <3><Locomotive><Walk>[<in><SafetyRoom>] <4><Decisional><choose>[<equipment>] <5><Operative><collect> <6><Decisional><choose>[<cloths>] <7><Operative><collect> <8><Locomotive><run>[<out><SafetyRoom>]	<1><Locomotive><Walk><Enter> <2><Locomotive><Walk><in> <3><Decisional><choose><equipment> <4><Operative><collect> <5><Decisional><choose><cloths> <6><Operative><wear> <7><Locomotive><Walk><out>

By creating a list like Table 1, the assessment system creates feedback for learners showing the errors, extra actions, and correctly performed actions; all with extended explanations. The system reflects the mapped sequence and compares it with the reference solution. The relevancy of actions will be assessed in three different levels. First level is the lowest rated (Action Class), the second level is Action Class and Type, and the third and the highest level of relevancy is an exact match of actions with the experts' reference solution.

Why do educators need ALAM?

The significance of learning assessment is well established and accepted among educators. Immersive virtual learning environments such as virtual worlds, games for learning, virtual training environments, and simulators play an important role in today's education and assessment is an inevitable part of it. Not all training courses are cost effective and safe or even available. There are so many training courses with high costs and safety issues involving human lives like nuclear power plants, mining, army training, chemical labs, and mining. There are different available 3D virtual training systems to teach these courses but few of them have the ability of assessment and even fewer support feedback. An expert usually creates provided feedbacks during or after the assessment that is so time consuming for experts and very expensive for training institutes and companies and not forget to mention that in so many fields of knowledge, the number of experts is very limited.

To overcome this limitation, ALAM proposes a new approach towards assessing learners, based on their performed actions in virtual training environments to achieve a predefined goal or solve a problem. Using this assessment method provides the opportunity for learners to learn from their mistakes and repeat the assessment until they master it without the waste of financial and human resources. It also enables educators to assess more effectively and efficiently a higher number of assessable learners in less time. Furthermore, educators have the freedom of creating new problems, add different solutions, extend the taxonomy and redefine the actions due to their needs; which offers a greater flexibility.

Conclusion and Outlook

Automated Assessment with formative feedback based on the actions and performances of learners in Virtual Training Environments is still not established. With ALAM, we suggest a method for the educators to automatically assess their trainees, online and in real-time, and overcome the dependency on experts and reduce the waiting time for students to receive their formative feedback. ALAM recognises trainees' actions using the taxonomy of actions for Action-based Learning Assessment, developed specifically to be used for this method. Receiving the list of performed actions enables the assessment system to compare these actions and their sequence against the reference solution to the given problem. ALAM is currently an ongoing research project, yet the first outcomes demonstrate the need for these systems and the potential to provide a powerful tool to educators who use action-based learning and virtual environments. This paper described the concept of ALAM from an educator point of view; thus focuses on the non-technical aspects and the introduction of ALAM itself.

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Improving retention in first-year mathematics using learning analytics

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Despite the importance of mathematical skills in quantitative disciplines, high failure rates in first-year university mathematics subjects have been observed in many parts of the world. Mathematics support provisions are established in many tertiary institutions in order to assist at-risk students to master and pass mathematics subjects. However, while a significant amount of data is being collected on students (e.g. entry scores, backgrounds), their behaviour (e.g. access of support services, engagement with online resources) and their performance (e.g. in assignments, tests), not much analysis is currently done with this data to predict a student's chances of success, and to better guide the services of mathematics support centres and target intervention procedures. This paper reviews relevant literature and describes a proposed research project to improve retention in first-year mathematics using a learning analytics approach.

Keywords: first-year mathematics, mathematics support, retention, learning analytics

Introduction

The lack of mathematics prerequisite skills at tertiary level has been recognised as an issue since the late 1970s and is known as the 'mathematics problem' (Rylands & Coady, 2009). It is a serious problem even in developed countries. Many first-year university students are struggling to pass mathematical subjects, especially those studying in quantitative areas such as engineering and science (Wilson & MacGillivray, 2007). High failure rates in mathematics subjects and lower retention in disciplines with mathematics-intensive subjects have prompted tertiary institutions to set up some form of mathematics support in order to assist these students from failing these subjects. Studies have been undertaken to identify these students with weak mathematics skills and refer them to available mathematics support and intervention schemes. However, regarding mathematics support, so far only a limited number of academic performance variables have been used to determine which students are to be classified as "at-risk" (see, for example, Croft, Harrison, & Robinson, 2009; Lee, Harrison, Pell, & Robinson, 2008).

In the United States and some European countries, learning analytics and educational data mining approaches have been used to predict student performance, identify at-risk students, and set up intervention schemes in order to help students passed their subjects. While many studies have been done in this area, none of them integrated mathematics support variables in their research (e.g. Arnold & Pistilli, 2012; Garcia & Mora, 2011). This concise paper will introduce a project that attempts to close this gap. It will incorporate mathematics support aspects in a learning analytics approach to improve student retention, and to achieve this aim, a new intervention strategy to assist at-risk students in first-year mathematics will be configured. This paper is organised as follows. Firstly, it reviews the relevant literature on mathematics support and learning analytics, and critically evaluates the papers to justify the need for this project. Secondly, it describes the project plan; and finally, it concludes with expected outcomes of the project.

Evaluating mathematics support and its role to increase student retention

Mathematics support provision was initially set up to assist at-risk students to ease their transition into university. As a general term, mathematics support provision normally ranges from introductory mathematics courses offered before the semester begins, drop-in learning/help centres, help desks, pre-booked individual appointments, exam revision support, or peer-assisted support (Parsons, 2008), to online support that provides materials (lecture notes documents as well as videos) that can be accessed from anywhere via the internet in the students' own time (Loch, Gill, & Croft, 2012). Mathematics support is now common practice in many universities in many parts of the world. Drop-in learning centres in particular have been established mostly in the UK, Ireland, and Australia, and they now cater for students with a range of different mathematical abilities (Gill, Mac an Bhaird, & Ní Fhloinn, 2010).

Many studies have been undertaken to measure the impact of mathematics support services on students' grades and retention rates. Factors such as past examinations, student grades, diagnostic tests, and whether or not students make use of a range of available mathematics support were used. The last factor was found to be important as it seems students who make use of mathematics support tend to perform better in mathematics, as evidence provided by, for example, Croft et al. (2009) and Mac an Bhaird, Morgan, & O'Shea (2009).

Studies into the effectiveness of mathematics support in improving student progression and retention involved more complex issues than academic performance variables alone. Patel & Little (2006) and Lee et al. (2008) concluded that in order to improve student progression and retention, diagnostic tests should be followed by mathematics study support provision.

Evaluating learning analytics and its applications

The 21st century has seen the collection of data expanding as a result of extensive uses of the web for learning, and with this the term "analytics" is now widely used in many areas. The application of analytics in education is often referred to as educational data mining and learning analytics (Romero & Ventura, 2007; Siemens et al., 2011). These terms are similar in many ways, and overlapping research studies in the two disciplines were observed (e.g. Romero-Zaldivar, Pardo, Burgos, & Delgado Kloos, 2012). However, as a rule of thumb, Siemens & Baker (2012) explained that educational data mining focuses on technical aspects of computing algorithms and automated discovery, while learning analytics focuses more on the educational side, i.e. empowerment of human resources (instructors and learners).

There have been a few implementations of learning analytics projects on campus. The most recognized project is Course Signals at Purdue University, which was automated in 2009. The Course Signals features real-time feedback, early intervention, as well as frequent and on-going feedback, which are essential in identifying at-risk students, both for the faculty (lecturer, tutor, retention coordinator) and the students themselves. For students, it is very simple to comprehend; each student receives 'signals' similar to traffic signals (red, yellow, or green) in their Blackboard site regarding to each course s/he is currently taking. Lecturers can track students with yellow or red signals as early as from the second week of the semester, and can therefore decide early on what kind of intervention is suitable to help a particular student (Arnold & Pistilli, 2012).

In particular, the Course Signals project is very much in line with our study, as it aims to predict on-campus student performance on an individual basis and attempts early intervention for at-risk students. The system's ability to involve thousands of students across many disciplines and courses is outstanding. Nonetheless there are gaps in their project that can be filled by our study, which will be explained below.

The first difference is that Course Signals does not target any particular course or discipline to reach its goal. On the other hand, our study targets specific students, i.e. engineering students taking mathematics subjects, whose circumstance might be different from other disciplines. Secondly, Course Signals only use variables around academic performance and mainly students' online engagement with their courses. In contrast, our study will also use students' socio-demographic variables as well as their secondary school academic performance, in addition to their academic performance in the tertiary level. Lastly, in predicting student performance, Course Signals does not involve any variables regarding learning support, in particular mathematics support, which can be accessed by students in order to help them with their study. On the contrary, our study will focus on the mathematics support aspect, whether and how students engage with the available support, not only to pass but also to improve their understanding of mathematics subjects.

Learning analytics to improve retention with integration of mathematics support aspects

So far there has been no research on identifying at-risk students or predicting student performance using learning analytics and educational data mining that integrates the mathematics support aspects. Focusing on data mining techniques, Garcia & Mora (2011) mined data of over 6500 engineering students with 57 independent variables, but did not use mathematics support variables. On the other hand, Lee et al. (2008) incorporated one mathematics support variable, but only used a small data set (133 observations in one semester, 14 independent variables). Studies of such small size do not quite belong to learning analytics research as per the current definition.

In Australia, Loch & Elliott (2012) carried out a preliminary study to investigate the effectiveness of the current retention strategy in terms of mathematics support provision. This study extracted one cohort of 77 civil engineering students taking a single mathematics subject, analysing six variables in a descriptive manner. This study will extend the previous study, by analysing large data sets of several cohorts of engineering students with different majors taking different mathematics subjects.

By using data from a range of various sources instead of only academic performances, it is hoped that a new intervention strategy can be proposed to improve retention in these mathematics subjects, to the benefit of the faculty and the university. It will also add to current research on best practice of mathematics learning support and retention in mathematics education in general.

Proposed Methodology

In this study, we will learn from **past student data** to understand the **present challenge** we are facing in tackling the 'mathematical problem'. **Future performance** of current students will be predicted within the semester in order to prevent them from failing mathematics subjects, thereby improving retention.

This study will take a learning analytics approach to first-year student data sets at Swinburne University of Technology. These students have access to mathematics supports provided by Swinburne's Mathematics and Statistics Help (MASH) Centre. It will include four cohorts (2011 to 2014, i.e. past, present, and future data) of all first-year engineering students taking one of two core mathematics subjects with large enrolments, which is expected to be around 5,000 students in total.

Datasets will incorporate demographic, socio-economic and student academic performance variables, as well as data from the MASH Centre visits and access to 'Mathscasts', i.e. online support materials (Loch, Gill, & Croft, 2012) provided by the MASH Centre. Secondary school data such as VCE mathematics scores as well as university entry scores will also be included. Past student data will be evaluated and statistical models will be built on this data to predict the likelihood of student success in these subjects. These models will be verified with current student data, constantly updated on a regular basis to improve the models as the students are progressing through the semester.

At-risk students will be identified during the semester using predictive models that will employ all available variables. Certain behaviours of students regarding their engagement or non-engagement to the MASH Centre and its online support will also be taken into account, in order to configure triggers for an intervention strategy. These at-risk students will be referred to the faculty retention strategy coordinator, who will implement support services for these students as suggested from the data analysis. At this stage, ethics approval has just been granted and access to the data will commence shortly.

Statistical approach

Data mining techniques such as regression, decision trees, and support vector machines, as well as ensemble techniques will be applied to identify significant variables that contribute to student success as well as student failure in the mathematics subjects evaluated. Different predictive models, one for each past cohort and subject, will be built to identify which student is likely to be at risk of failing the subject based on all data available.

The models will be evaluated to assess their accuracy. In order to do this, data on each cohort/ subject regarding each model will be split in two groups, i.e. a training set to train the model, and a test set to test the model to determine the model's accuracy. These models will be regularly updated with the addition of current data, and evaluation of the models will be performed accordingly. Ensemble models will also be exercised as they usually yield more robust predictions compared to individual models (Delen, 2010). In this way, higher prediction accuracy is expected to identify at-risk students and predict student performance.

Expected outcomes

Expected outcomes of this study are:

4. "At-risk" criteria in first-year mathematics are well defined based on suggestions from the data analysis.
5. Applying these criteria on identification of at-risk students means that more students can be assisted to master and pass mathematics subjects, particularly if they do not avail themselves of mathematics support provision out of shyness and reluctance.
6. More proper and targeted intervention strategy to assist at-risk students from failing mathematics subjects.
7. Understanding students' behaviour in engaging with mathematics support provision, in order to configure improvement of the provision according to each student's needs.
8. Improved retention in first-year mathematics.

Conclusion

This proposed study will apply a learning analytics approach to identify how retention in first-year mathematics could be improved where mathematics support provision is available. It is an endeavour to combine two areas of research which previously seemed to have been investigated separately, i.e. learning analytics and mathematics support. This study will contribute to ways of improving retention in the light of available mathematics support provision.

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Revisiting the definition of Mobile Learning

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Mobile learning is increasingly seen as a boon to universities and educators as a means of enabling learning anywhere, anytime and at the convenience of the learner. Even though the field of mobile learning is in its infancy, there is no common understanding of what mobile learning is. Previous attempts at defining mobile learner have either been overly inclusive or exclusive, and have focused on characteristics of the mediating technology, the learner, or the nature of the learning activity. Inspired by Wittgenstein's theory of family resemblances, this paper explores the attempt to create a new definition of mobile learning that will be dynamic, drawing from a collection of characteristics that may change over time rather than just supplying a single, unchanging definition. The revised definition will be used to support the development of a Mobile Learning Evaluation Framework by clarifying the attributes and features to be included in a robust and flexible definition of mobile learning. The outcome may be of value to researchers in the mobile learning field and educators considering incorporating mobile learning initiatives into current pedagogical strategies.

Keywords: mobile learning, m-learning, smart mobile technologies, mobile learning definition, Delphi technique

Introduction

Since the first brick-like mobile phones appeared on the market in the 1990s, mobile computing technologies have developed briskly, facilitating increasingly sophisticated ways of interacting and communicating. As a result of the incremental improvements in design, tendency towards reduced size, increased functionality, improvements in data storage capability, and the reliability and ubiquity of the networks that support them, mobile technologies have become essential to the conduct of people's everyday lives (Evans-Cowley, 2010). In the educational context, ubiquitous connectivity and the portable nature of these devices facilitates access to collaborative and contextualised learning experiences which translate into greater ownership of learning processes (Wong, 2012). Furthermore, these technologies are becoming ever more affordable, presenting unique opportunities for facilitating the flexible delivery of contextualised learning experiences for diverse student cohorts.

The field of mobile learning is relentlessly advancing and new research studies that explore the affordances of mobile technologies in learning environments unfold on a regular basis. Nevertheless, researchers are still struggling to develop a consensual definition of mobile learning that is sufficiently distinct from e-learning (Traxler, 2010) in terms that are educationally relevant (Guy, 2010). Traxler (2007) emphasised that the characteristics of mobile learning contribute to the difficulties in developing a definition. He identified three characteristics: personal, contextual and situated, that contribute to the 'noisiness' of the term. Furthermore, he cautions that the inherent informality associated with mobile learning may place the definition at odds with formal education structures and processes. These are some of the challenges faced by those attempting to conceptualise a definition of mobile learning that suitably encapsulates the unique affordances and potential value of mobile learning within formal education environments.

In late 2012, a team of 13 multidisciplinary researchers from the University of Southern Queensland, the University of South Australia and the Australian National University embarked on a three year project to develop a Mobile Learning Evaluation Framework (MLEF) (see Murphy & Farley, 2012). The first step in this journey required clarification of the precise meaning of the term 'mobile learning'. Each of the team members were in their own way struggling with their personal meanings of mobile learning and had found evidence in their own interactions with fellow educators that the meaning of mobile learning was contested. As a consequence of this disparity in understanding, educators appeared to be unsure of role and value of mobile learning within existing teaching models and how to effectively utilise mobile technologies to support student engagement. The team decided to embark on a research study using a staged approach to review definition frameworks of mobile learning currently available in the literature and explore the possibility of developing a new structure. The revised definition of mobile learning will support the foundations of a larger project to develop a Mobile Learning Evaluation Framework as the project team will have greater clarity about the breadth of technologies and functions that can be understood to describe the nature of mobile learning. The revised structure will also permit identification of components that are currently missing from existing definitions of mobile learning, thereby supporting further research and development within the field. This paper provides a short overview of the methodology adopted to achieve this aim and a glimpse into the findings from the first phase of the project.

Previous attempts to classify definitions of mobile learning

There have been several attempts to classify the definitions of mobile learning used in the literature into a comprehensive framework. John Traxler (2010), Professor of Mobile Learning at Wolverhampton University, identified that three categories of mobile learning have been used in past literature. He identified that early approaches to defining mobile learning tended to focus on the nature of mobile devices, referring particularly to handheld or palmtop electronic devices. The next generation of definitions exhibited a greater focus on mobility, but was largely still directed towards the mobility of the technology. The third category moved away from considerations of the technology to emphasize the mobility of the learner and the learning process. Those definitions which incorporate a description of the technology are in danger of becoming obsolete as mobile technologies and the capabilities of these technologies are changing at a rapid rate.

Sharples and colleagues (2005) emphasised that most theories of learning are based on the assumption that learning occurs in a fixed environment, paying scant attention to the mobility of learners. Their definition was purported to be distinct from previous definitions and theories of mobile learning because they focused on the continuous movement of the learner. Instead of learning being placed linearly along a set curriculum, they considered it to occur across five moving facets of the learner's environment:

1. Learning between various locations, though not necessarily while moving or on transport;
2. Learning across space as ideas and resources are moved between and across contexts;
3. Learning across time by revisiting knowledge obtained from previous learning;
4. Learning between topics as learners move continuously between competing priorities and topics of interest; and
5. With or without engagement with technology for example moving in and out of network coverage.

Sharples' theory highlights the fact that learning has changed, with specific emphasis on the mobility of learning. Traxler (2007) additionally suggested that mobile learning may not in fact be about learning or mobility however may be about the mobile conception of society. This again highlights the requirements of a mobile learning definition that is able to accommodate changing technologies, the way we are able to use these technologies and the societal changes and expectations that will drive the two.

Advances towards an operational definition of mobile learning will only be achieved if there is sufficient understanding of the characteristics and affordances attributed to the term. Ludwig Wittgenstein proposed his theory of family resemblances to explain the development of the extension of concepts over time. He espoused the idea that certain classes of referents could not be specified by a determinate property, but instead proposed that possession of a group of properties could indicate that something should probably belong in a certain class. He used the analogy of a family possessing certain characteristics of appearance as an indication of their relationship to one another (Wittgenstein, 1968). This theory can be readily extrapolated to encompass mobile learning. As educators, we think we know what mobile learning is. If we see an educational activity, in most cases we are able to determine if it is an example of mobile learning or not. There are certain terms and conditions we associate with mobile learning, yet every instance of mobile learning does not possess each and every one of these characteristics. Definitions of mobile learning get bogged down when they attempt to be inclusive enough to accommodate mobile learning in all of its variety, including a wide variety of technologies, many not yet invented, but exclusive enough to differentiate mobile learning from e-learning or informal learning for example.

Methodology and preliminary findings

In an attempt to overcome these challenges, the project team are developing a new way of defining mobile learning. This new definition will be dynamic, drawing from a collection of characteristics that may change over time rather than just supplying a single, unchanging definition. A staged approach was designed and is currently underway. It includes a comprehensive review of the literature, surveys, team workshops and a Delphi survey that will form the foundation of this research. The following section briefly outlines each stage of the approach as well as discusses preliminary findings from the research stages that have already been completed.

Preliminary survey to define mobile learning

The project to develop a Mobile Learning Evaluation Framework commenced formally in October 2012. Soon after, a short survey was developed to facilitate awareness of the project among the education research community and encourage engagement with potential stakeholders. This survey formed the first stage of the journey towards understanding how educators and researchers conceptualised mobile learning and how these ideas aligned with the existing research literature. A link to the survey was made available on the project website as well as through Quick Response Codes (QR) that were printed on postcards. The postcards were handed out at the formal launch of the Collaborative Research Network (CRN) project at the University of Southern Queensland and the 2012 ascilite conference in Wellington, New Zealand, both held in November 2012.

Approximately 100 postcards were handed out at these events and responses from 26 participants were received. The majority completed the poll using their mobile devices (14, 54 per cent) of which nine used an iOS operating system (OS), one an Android OS and another a Windows OS. Laptop computers were used by seven respondents (27 per cent), three used Apple iPads (12 per cent) and 12 used desktop computers. Each respondent was simply asked to state how they would define mobile learning. Although only a few responses were received to this short answer question, the themes that arose from the proffered definitions reflected the lack of consistency in defining mobile learning as well as some concern about the value of the term. Unsurprisingly, these definitions were rather exclusive and focused on the types of technology or style of learning activity. This provided some food for thought for the project team and a workshop was planned to try and make sense of some of the issues around defining mobile learning.

Project team workshop

The exchange of information, meaning and dialogue has been identified as one of the central features of effective team practice (Ovretveit, 1996). Two workshops were held with project team members to identify the personal assumptions and beliefs about mobile learning. The team members on the MLEF project originate from a range of disciplines including the sciences, humanities, business, education, mathematics and computing. The outcomes of these discussions were considered to be a first step towards the development of a multi-disciplinary definition of mobile learning. The first meeting consisted of a half-day workshop during which team members collaboratively identified 31 characteristics or attributes of mobile learning. These attributes were placed on a continuum from ideal to imperfect mobile learning conditions. A list of the characteristics identified can be seen in Figure 1.

A second workshop was held a few weeks later to further categorise these attributes into family groups. Eight family groups were identified. The next step in this process is to compare the attributes and family groups identified by the team members to existing literature studies and determine points of difference.

Delphi technique

The workshop findings will be complemented by the results of a Delphi investigation. The use of formal consensus techniques have previously been found to be helpful with definition development in situations where no gold standard exists, potentially reducing bias and resulting in a definition with improved characteristics (Ferguson, Davis, Slutsky & Stewart, 2005). The Delphi technique is an iterative process where experts are polled individually with a series of questionnaires, receiving anonymous group feedback between iterations, to develop a formal definition of mobile learning. The Delphi technique was chosen because of its ability to overcome geographic constraints, low costs and ability to ensure all panellists have an equal voice in the proceedings (Riggs, 1983).

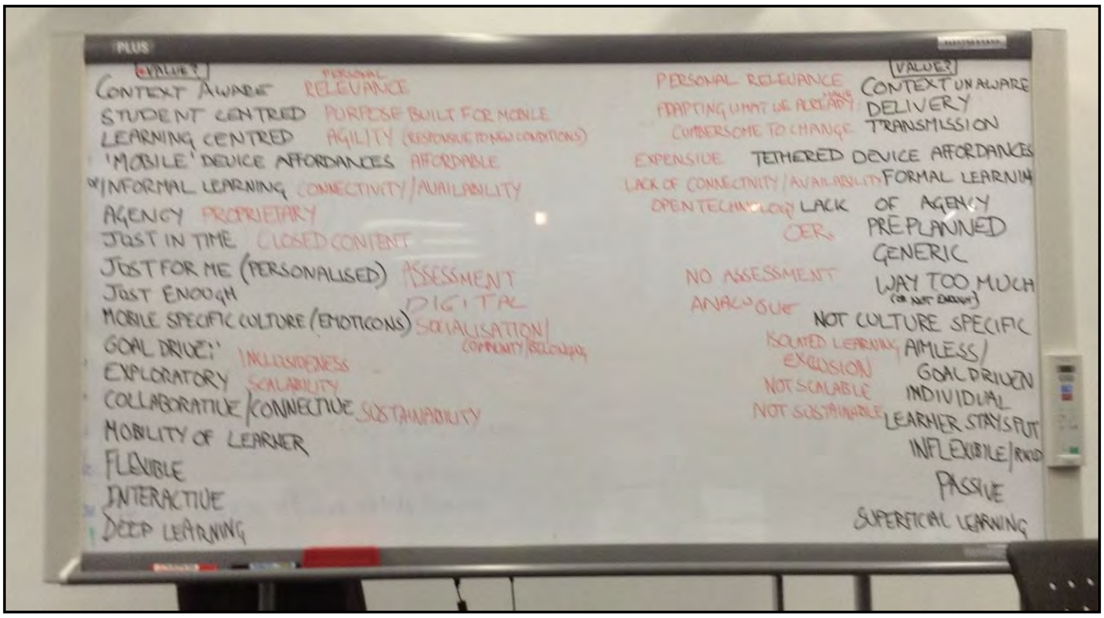

Figure 1: List of characteristics identified by the project team in Workshop 1.

The process consists of a three-stage panel survey with researchers, educators and theorists who have published in the field of mobile learning between 2005 and 2013. The first phase was conducted between February and May 2013. The survey consisted of two open questions and eight demographic questions. In the first question participants were asked to list all possible extrinsic or intrinsic characteristics that should be included in the definition of mobile learning. For the second question, participants were asked to create an operational definition or clear example of each of the characteristics they mentioned in order to provide adequate context for each definition. Email invitations were sent to 49 researchers identified through the literature review, as well as to a number of online mobile learning groups. Those who wished to participate in the survey contacted the research team and were sent a personalised link to the survey to enable the research team to track responses and ensure that participants met the publication criteria. Responses from 30 participants were received.

Next steps: building and testing the new definition framework

The next step in the research process involves consolidating the attributes identified in the short survey, team workshops, first phase of the Delphi study and relevant attributes from a review of the literature into a series of categories. These categories and attributes will be submitted to researchers in the mobile learning community, including participants from the first phase of the Delphi study, to determine whether they agree or disagree with the team's selection of the categories for the attributes, the distribution of the attributes across the categories and for any additional insights. The final stage will involve consolidating the revised attributes and categories and presenting a revised definition to participants for final comment. Only participants who have been involved in the second phase of the Delphi study will be permitted to participate in the final stage. Participants will be provided with the opportunity to agree or disagree with the final definition, submit additional comments or provide a rational for disagreement.

Conclusion

Current definitions of mobile learning tend to be overly inclusive, in that just about any e-learning activity can be classified as an example of mobile learning, or overly exclusive through only allowing the inclusion of learning activities mediated through very particular mobile devices. With the emergence of innovative mobile technologies with new affordances, emerging pedagogies to accommodate new modes of learning, and an increasing demand for learning anytime and anywhere at the convenience of the learner, the demand for a dynamic definition of mobile learning is acute. The authors are part of a project team developing a Mobile Learning Evaluation Framework. Inspired by Wittgenstein's theory of family resemblances, they are also working on a new definition of mobile learning that is dynamic and drawing from a collection of characteristics that may change over time rather than just supplying a single, unchanging definition. This paper outlines the process which the project team is undertaking to arrive at such a definition.

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Use of Echo360 generated materials and its impact on class attendance

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Echo360 lecture capture system has become widely used in Australian universities. However, there are concerns about how Echo360 generated materials are used by students and the effects of its use on student learning. The paper draws on data from an inter-disciplinary project that aimed to investigate the role of Echo360 lecture capture system on learning and teaching at the University of Tasmania. Initial findings showed that the majority of respondents used Echo360 generated materials to help them better understand face-to-face lectures, review notes, prepare for assignments and examinations, rather than using the materials as an alternative to attending lectures. Contrary to some published findings, this study found that the availability of Echo360 generated materials did not necessary result in low class attendance. Over 86 per cent of respondents still considered face-to-face lectures to be of high value and attendance was necessary to promote their learning.

Keywords: Echo360, lecture capture, personal capture, class attendance

Introduction

There has been increasing interest amongst lecturers at Australian universities to explore ways of improving teaching efficiency and learning outcomes. The availability of technology such as Echo360 lecture capture system has provided a platform for transforming learning within higher education. However, there is a lack of empirical evidence in relation to: a) the possible correlations between the use of technology-initiated (or enhanced) methods and student performance; b) the impacts of using technology (e.g. lecture capture) on class attendance and students' performance; and c) the potential benefits brought by technology-driven initiatives on the organisation and delivery of course materials in more efficient and effective ways. Consequently, some lecturers are reluctant to embrace technology-driven initiatives such as Echo360. There is particular interest in the use of technology-driven initiatives when learning and teaching activities involve on-campus and distance students that have different learning needs.

This paper presents findings from an interdisciplinary project, investigating the transformative role of Echo360 lecture capture system materials on learning and teaching, at the University of Tasmania. While the project intends to address all three aspects, this paper aims to address how students use Echo360 generated materials and how the availability of such materials affects student attendance.

Echo360 generated materials and class attendance

Echo360 lecture capture system provides four recording choices based on the curriculum, instructor preference and the technical complexity of the venue being captured: capture appliance; classroom capture; personal capture; and media import. The two most common choices in Australian universities are automated lecture capture using the capture appliance (lecture capture) in Echo360-enabled venues and personal capture at any computer using Echo360 personal capture software and the use of a headphone with a speaker. Nationally, more than 60 per cent of Australian universities have used Echo360 software in their lecture theatres and classrooms, many capturing over 1,000 hours of lectures each week (NetSpot, 2011). For example, the University of Tasmania has 34 Echo360-enabled venues. The University of Queensland, offers Echo 360 lecture capture systems in venues with a capacity of over 100 students.

Educational technologies such as Echo360 lecture capture system provides students with an easy option to access course materials online from anywhere and at any time. However, there are concerns from academics that easy access to captured lectures will create absenteeism and decrease content learning (Stewart, et al., 2011). For example, Massingham and Herrington (2006) assert it is not the educational technologies and the materials generated by the technologies that have introduced absenteeism, rather the character of students has much more influence over absenteeism. Mark, Vogel and Wong (2010) suggest that using Echo360 does not necessarily encourage truancy among students but rather motivates them towards revision of course materials. The accessibility and flexibility offered by Echo360 generated materials to students is what makes revision easy. Most students appreciate access to lecture-capturing technologies (McNeill et al. 2007). Phillips (2006) however, states that readily available learning materials generated by using Echo360 system may lead to cramming; a condition where students only revise their course materials at the latter stage when examination or assessment time is approaching. Some students may not revise the captured lecture materials at all (Philips 2006). Davies and Hardman (2010) find that the most common reasons for this phenomenon include preoccupation by students with other commitments, a lack of awareness of its availability, and unfamiliarity with technology. Thus, the relationship between ready access to course materials outside of the classroom and classroom attendance appears to be influenced by students' preferences and behaviour.

Echo360 lecture capture system and other educational technologies with similar features makes classroom proceedings available to students online (Williams & Fardon 2005). This is particularly advantageous to students who need to meet various commitments in relation to employment, health as well as childcare issues that reduce the opportunity to attend class regularly (Vajoczki, Watt & Fenton 2011). The use of Echo360 is advantageous to both students and lecturers as they respectively rely on it to improve access and enable revision opportunities. This increased accessibility may also increase teaching quality (Mark, Vogel & Wong 2010).

Some negative influences on learning and teaching behaviours that may have resulted from the use of Echo360 have been identified in literature. Mark, Vogel and Wong (2010) report that the use of Echo360 may lead to reduced classroom interactions, especially among shy students. The literature reveals that students may adopt different learning patterns in relation to how they use materials generated from lecture-capturing educational technologies such as Echo360. The work of Phillips et al. (2010) provides ten categories of behaviours that students may exhibit towards the use of electronic learning environments that rely on lecture-capturing technologies. With the emergence of educational technologies such as Echo360, the behaviour of non-attendance may inevitably increase. Hence, Massingham and Herrington (2006) concluded that the focus of educators should be on how to harness existing technologies to improve the learning and teaching behaviours of stakeholders, rather than increasing attendance. The paper intends to answer these two questions:

i. What were the purposes of students using Echo360 generated materials?
ii. To what extent did students rely on Echo360 generated materials with reference to class attendance?

Methodology, results and discussion

A questionnaire consisting of five parts was designed to address the objectives of the project. Findings presented are derived from Part A of this questionnaire. The survey was published online to take advantage of online survey (Wright 2005). An invitation was sent to students enrolled in five units across multiple disciplines at

University of Tasmania including management, engineering, and nursing. The total number of students enrolled in these five units was 841 with both on-campus and distance study. 244 valid responses were received representing 29 per cent response rate. SPSS (v.21) was used to perform the statistical analysis.

As presented in Table 1, among the nine listed purposes of using Echo360 generated materials, *revise and prepare for examinations (A1.3), replay and revise key concepts that were too difficult to grasp during class sessions (A1.2), gather information for assignments (A1.4),* and *revise notes that were made in classes (A1.1)* were the highest rated with over 80% of agreement. *Acquire presentation skills (A1.7)* and *want to experience what a real class feels like (A1.9)* were ranked among the two lowest with 45.1% and 36.9 % of agreement among respondents. For class experience, the reason for the low agreement may be attributed to the low percentage of participation by distance students in the survey, as the question was intended to collect views from those who do not have face-to-face interactions with lecturers.

Table 1: Purposes of using Echo360 generated materials

Item	SD	D	N	A	SA	% A&SA
A1.3 Revise and prepare for examinations	5	2	24	119	94	87.3
A1.2 Replay and revise key concepts	4	7	22	136	75	86.5
A1.4 Gather information for assignments	2	4	36	130	72	82.8
A1.1 Revise notes that were made in classes	5	9	29	135	67	82.8
A1.6 Cover-up for missed lectures due to other commitments	12	14	43	79	96	71.7
A1.5 As an alternative to traditional physical lecture attendance	18	15	48	89	74	66.8
A1.8 Collect feedback given by lecturers on assessments	12	27	63	89	53	58.2
A1.7 Acquire presentation skills	12	43	79	73	37	45.1
A1.9 Want to experience what a real class feels like	28	31	95	57	33	36.9

SD: strong disagree; D: disagree; N: neither agree nor disagree; A: agree; SA: strongly agree; % A & SA: total percentage of agree and strongly agree

Table 2: Class attendance and the use of Echo360 generated materials

Variable	Frequency	%
A2.1 Rely only on traditional lectures without using Echo360 materials	29	11.9
A2.2 Rely on both traditional lectures and Echo360 materials	182	74.6
A2.3 Rely on only Echo360 materials without attending lectures	29	11.9
A2.4 Rely on neither traditional lectures nor Echo360 materials	4	1.6
Total	244	100.0

Table 3: Post Hoc Tests of the use of Echo360 materials and class attendance

Dependent variable	Independent variables		M Dif	Std. Err	Sig.
A1.3 Revise and prepare for examinations	Rely only on traditional lectures without using Echo360 materials	Rely on both traditional and Echo360 materials	-.64153	.15824	.001
		Rely only on Echo360 materials without attending lectures	-.60269	.20784	.032
A1.4 Gather information for assignments	Rely only on traditional lectures without using Echo360 materials	Rely on both traditional and Echo360 materials	-.53316	.14907	.006
		Rely only on Echo360 materials without attending lectures	-.55172	.19579	.050
A1.5 As an alternative to traditional physical lecture attendance	Rely only on traditional lectures without using Echo360 materials	Rely on both traditional and Echo360 materials	-.65233	.22612	.042
		Rely only on Echo360 materials without attending lectures	-1.51478	.29501	.000
	Rely on both traditional and Echo360 materials	Rely only on Echo360 materials without attending lectures	.86245	.22272	.002

As for the possible effects of Echo360 materials on class attendance, a majority of students did not solely rely on lecture capture (Table 2). Overall, 86.5 % of respondents did not agree that the use of Echo360 material would affect class attendance, among which 11.9 % relied only on traditional lectures without using Echo360 materials (A2.1), and 74.6 % rely on both approaches (A2.2). It is not clear though whether the 11.9 % of respondents who relied solely on Echo360 materials were studying only off-campus.

One-way ANOVA was performed to examine whether students differed in terms of their purposes of using Echo360 materials and possible behavioural changes on class attendance as a result of using these materials. The results show that five of the nine listed purposes reached statistically significant difference (between groups) at 95% confidence level, including A1.1 (.017), A1.2 (.028), A1.3 (.001), A1.4 (.017), and A1.5 (.000). To reveal which groups differ, Post Hoc Tests were performed and the results are shown in Table 3. Since the significance levels of A1.1 and A1.2 in the tests were above 0.05, these two items were removed. The test results show (Table 3) that those who rely on traditional lectures without using Echo360 materials have significantly different views from those who rely on both traditional lectures and Echo360 material and those who rely only on Echo360 materials without attending lectures, on the use of the materials to: a) *revise and prepare for examinations* (A1.3), b) *gather information for assignments* (A1.4), and c) *as an alternative to traditional lecture attendance* (A1.5).

The results indicate that a majority of students used Echo360 generated materials for revision, replaying key concepts, and gathering information for assessments. This result coincides with that of Gosper et al. (2008). Regarding the impacts of Echo360 generated materials on class attendance, the study found that the availability of lecture capture did not have a significant impact on attendance, a finding that is consistent with that of von Konsky, Ivins and Gribble (2009) while different from Traphagan, Kucsera and Kishi (2010). The differing findings from the literature might be attributed to the different context in which studies were undertaken. An interesting finding was that those who did not use Echo360 materials (representing 11.9%) highly valued traditional lectures and the way they collected information for assignments and did their revision for examinations, while somehow resisting the use of Echo360 materials in the process. It was unclear though what caused the difference without further analysis of demographic information, for example age groups.

Conclusion

For a majority of students, Echo360 generated materials complemented traditional lecture attendance and were used mainly for reviewing lectures and notes, gathering information for assignments and examinations. That Echo360 generated materials can be accessed at any time repeated at their own pace, as often as needed, provides students with increased flexibility and convenience. The findings of this study show that the availability of Echo360 generated materials does not necessarily contribute to low class attendance. A majority of respondents still considered traditional lectures to be of high value and necessary to attend. The significant differences between those who relied solely on traditional lectures and those who relied on Echo360 generated materials in terms of how they view and use these materials require further exploration.

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Communicating with peers online: What do students expect of each other?

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This study looks at how students experience asynchronous online discussion (AOD) within initial teacher education. In particular, the study investigates what students expect of their peers when communicating online for the purpose of learning. Ascertained via an online focus group and interviews with students, findings indicate student preferences for academic netiquette. Student expectations can inform pedagogy for AOD if used as a basis for negotiation of guidelines for online communication.

Keywords: Communication, asynchronous online discussion, student perspectives, learning, pedagogy.

A mainstay of online learning, Asynchronous Online Discussion (AOD) is used in online courses in a range of disciplines. Online interaction between students can be both supportive and challenging, as peers express either their own breakthroughs in understanding, or their own struggles to understand. But what do students expect of each other when communicating online for learning purposes?

AOD is also referred to as web-based conferencing (Angeli et al, 2003), Electronic Discussion (ED) (Ferdig & Roehler, 2003), and Threaded Discussion/Conversation (Welser et al, 2007). These discussions occur in an Internet enabled environment without the need for discussion participants to be present in the same physical location or at the same time. In the discussions of relevance to this study, the participants are student teachers engaged in discussions for learning purposes. Each discussion is a formally constituted, topic-centred conversation established in the context of a specific learning environment (i.e., Moodle), using a web-based bulletin or message board (Locke and Daly, 2007).

Haythornthwaite and Andrews (2011) assert that "the asynchronicity of discussion boards is the mainstay of contemporary e-learning practice" (p. 210). There are often high levels of peer discourse in AOD (Hewitt, 2005), and in Clegg and Heap's (2006) view, this opportunity for student-to-student interaction "means that online discussions are often the glue that binds a group of students together to become a collaborative learning community" (p. 1).

Since learning collaboratively involves students' active involvement in peer interactions then it is important to ascertain what students want from their collaborators.

Research Context and Design

The University of Waikato Faculty of Education's Mixed Media Programme (MMP) was among the first of its kind in New Zealand (Dewstow, 2006; Donaghy et al, 2003). Established in 1997, this initial teacher education degree course was designed for primary pre-service teachers. Traditionally, MMP has catered for student teachers living at a distance from the University, blending on-campus block time, primary school placements and online study (Campbell, 1997; Donaghy & McGee, 2003; Donaghy, McGee, Ussher & Yates, 2003). Online study incorporates AOD as an interactive tutorial opportunity for MMP students, as well as a way of establishing attendance (Forbes, 2012). Typically, learning through AOD involves a series of (weekly) forums for students and lecturers to discuss literature and practice related to class topics throughout the semester. As such, this is the type of discussion activity that Hew and Cheung (2012) identify as a future research direction, given the emphasis on reading, philosophy, and the lack of face-to-face class time. MMP is the context for this study, in which 12 student teachers engaged in an online focus group for 18 weeks, and seven student teachers participated in a series of three semi-structured interviews.

Findings

Data were analysed with respect to what students expect of their peers in AOD. Several themes emerged, each of which are discussed in turn.

Relevant participation

Students said they expected their peers to join the discussion promptly and to post regularly. They said they expected peers to be experienced at managing their time in online discussion by their second year of study and were surprised by those who had to resort to double-posts due to time management issues:

> "What irks me is people who post but don't discuss. I know we have busy lives. But it irks me when fellow students haven't been in discussion all week, haven't bothered to read what has been discussed (I know they haven't when they repeat what has already been said without acknowledging this). Or they then post three posts in a row!! That frustrates me!" (Nina).

Students suggested that it could be challenging to have a flowing discussion when group members did not appear online until late in the week, disrupting continuity.

Students expected their peers to ensure examples and anecdotes or illustrations were relevant to the discussion topic and the discussants:

> "When considering the relevance of your postings, it is a good idea to be aware of the discussion group you are in and adjust your discussion accordingly. Try to be aware of where others are at" (Sarah).

While appreciating personal experience as a useful entry point worthy of exploring and sharing, students said they found fixation on personal experience to be limiting.

> "Every time we've gotten onto a discussion [it] has focused around how bad they were at maths when they were at school and so you know that seems to pervade the discussion and, so I get on there and try and politely change the tone of the discussion and say more or less you know you're not in primary anymore and I know those things can have some effect but trying to get them to see the positive side of those things instead of the negatives… Continually going on about your own experiences all the time, it's not enough" (Sarah).

On the other hand, the students wanted to talk about their lives and experiences and to relate their parental experience to discussions where possible. However, they expected peers to look beyond their own children as a sole point of reference. A wider, more diverse view of children in the school system was valued. Tarryn, for example, illustrated this point clearly:

> "One thing that's a huge turn-off to me is when people start talking about their personal experience in relation to their children and only their children. That's important but they need to bring it into the school system as well, they need to talk about their base school experiences and back up with their readings so it's sort of interweaving it… It is good when the discussion question, literature, classroom practice and personal experience (e.g. as parents) all link together, enabling students to engage in "interweaving" multiple sources of learning" (Tarryn).

The students unanimously appreciated opportunities to link theoretical concepts with classroom teaching incidents. Discussions that incorporated talk about learning in the classroom were considered superior to those perceived as more literary, without a practical element. When students related instances where discussions linked directly to classroom learning, they used words like "fantastic" and "exciting".

Responsiveness

Another expectation was that peers would acknowledge and respond to others in discussion. Students indicated that they expected others to read what had been posted rather than repeat or ignore points made by earlier contributors. Several students mentioned face-to-face etiquette regarding the impoliteness of ignoring others by repeating points already made online. For example:

> "…rude because you know that would be like if I was face-to-face with you and you've come and said something to me and I've just walked away and started talking to somebody else" (Sarah).
>
> "I felt like I'd made a valid point but it was completely ignored and it's just like well if we were in a group discussion once again, face-to-face, it would be like they all just turned their back on me and carried on talking" (Nina).
>
> "Same as in a classroom, someone's asked a question and then Johnny puts his hand up and says the same thing" (Tia).

The students reported a tendency to post more often in discussion when peers responded to posts and questions. They suggested that they would rather have their ideas actively challenged than ignored. For example:

> "I have noticed in a few discussions this semester that when someone has a different opinion from the rest of the group that person's ideas are ignored and no one responds to their comment. I know in one particular paper we are encouraged to disagree with the lecturers or others in the group but when someone disagrees and is ignored for doing so I feel like that voice is not heard. To even agree to disagree is better than ignoring what that person has to say" (Nina).

In a similar vein, the students emphasized that acknowledgement should move beyond bland agreement. The stock standard phrase "Oh yes I agree with so and so" could be overused, with one student describing this behaviour as "nauseating", "puppet"-like, and a hindrance to discussion (Tarryn).

Students appreciated names being used as part of peer-to-peer responsiveness. Focus group members said:

> "Names are important. It gives the discussion that human face when we wish we had one to look at!!" (Tarryn).
>
> "The importance of a name cannot be overstated. Naming the person online is equivalent to "looking" at that person in class" (Mei).

All of the students voiced an expectation of their peers connecting via AOD. They said that discussion provided a vital connection with their peers. They had difficulty envisaging MMP without online discussion components. Notions of connection and community were mentioned by all students:

> "Being able to connect with other people is pretty important to online learning I would have thought" (Don).
>
> "The plus of discussions is it keeps me connected to others - this is a lifeline" (Dana).

Leaving space

Leaving space was an expectation voiced by students, and referred to the need to keep comments short so as to avoid dominating discussion. The students conveyed a preference for posts to be succinct, and reported that they:

> "I hate having to trawl through really long discussions" (Jacqui).
>
> "I won't read them if they're too big" (Don).

Five of the seven students interviewed specifically expressed a dislike of lengthy postings. They agreed that when posts were too long, they typically skimmed rather than reading thoroughly. Contributions without paragraph breaks were similarly skipped over. Lengthy posts that attempted to address every point in one hit did not leave space for others to enter the discussion.

Free-flowing communication

A sixth student expectation related to the style of language used in AOD. It helped to write as they would talk, they said, putting things in their own words. They felt that discussion was better when people wrote honestly and sincerely ("being true to who you are"), rather than wallowing in academic jargon:

> "It was like we were actually talking to each other, that's when you know it's a good discussion… When it's free-flowing and you've got debate and it makes me look at things from a different perspective when someone's brought something up, something I wouldn't have considered … and I'm enjoying it and you're posting because you're really engaged in what you're actually talking about online" (Nina).

> "I think discussion should be more of a free-flowing thing rather than an academic writing exercise" (Don).

Effective use of literature

The students expressed particular expectations regarding how peers used literature in AOD, and were critical of the practice of copying and pasting material directly from set readings into the discussion.

> "I see a lot of quoting, retelling and reproducing rather than critical thinking in discussions, but I feel this is more because the onus on those particular discussions is on showing that literature has been read rather than making real connections to it through group discussion" (Don).

Students characterized this practice as false, pointless, irritating and confusing.

> "If everyone's just in there quoting the readings… I'm not learning anything because I've already done the readings. I'm just reading them all again… I mean, what is so interesting about going into a discussion and re-reading readings?" (Dana).

The students did not question the value of reading academic literature and regarded it as fundamental to their learning. They appreciated that readings could help them understand what they may not be seeing in schools, represent expert opinion and enlarge their experiences vicariously.

Recent research by Hew and Cheung (2012) supports some of these findings in relation to peer facilitation of discussion. In particular, Hew and Cheung (2012) report students' need for acknowledgement from peers, in the form of "sincere appreciation" (p.83). As in my study, their participants also advocated refraining from citing or quoting sources too often in online discussion.

In summary, the MMP students' expectations of their peers in asynchronous online discussion were that peers participate in a relevant and responsive manner, making human connections, leaving space for others by being succinct, communicating in a clear and free-flowing manner, and using literature effectively. These findings have subsequently been shared with other cohorts as a set of 'initial discussion guidelines' for critique and renegotiation by participants in online classes. Specifically, following this study, students have been provided with a rationale for discussion, and a set of 'do's and don'ts' based upon the expectations of previous online students. For example, the initial discussion guidelines advise students to:

- Respond to others in the discussion, building on ideas. Aim to ensure that others are acknowledged directly. Attempt to respond to different people throughout the discussion so as to be inclusive.
- When you refer to readings, avoid lengthy direct quotes in discussion. Instead, discuss readings by paraphrasing the key ideas and applying your own thinking to these.

The initial discussion guidelines take a blunt approach to warning students of online behaviours to avoid. For example:

- Do not post lengthy contributions. Research suggests that your fellow students will not read your posts if they are too long.
- Do not post without reading what others have said. This can be perceived as ignorant and disrespectful.

Follow-up research (Forbes, in press) indicates that students appreciate the guidelines, finding them helpful and reasonable, while also valuing the opportunity to propose modifications to the initial set of guidelines in order to evaluate, adjust and enhance discussion protocols over time.

Ultimately, this study reveals a little of students' expectations of their peers when communicating online in initial teacher education. Highlighting these participant perspectives generates possibilities for negotiation, change and improvement. That is, by making the perspectives, experiences and expectations visible, we render them revisible (Halse & Honey, 2010), inviting critical consideration of how to interact effectively within AOD in wider contexts. Understanding student expectations is a crucial part of understanding and informing present and future practice.

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Use of *Anatomage* tables in a large first year core unit.

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Anatomage tables were incorporated into a large core unit in health sciences at Curtin University to replace cadaver material. Students worked in groups of eight around the table, as one of several stations in weekly workshops facilitated by tutors. Tutors and students completed a survey asking about their use of technology and their experiences with the Anatomage tables. Tutors also contributed to focus groups (n=16), and student interaction around the table was recorded on camera. Student survey response was 18% (n= 326) and for tutors, 69% (n=22). Preliminary analysis suggests that most students found the Anatomage tables good for ideas of scale and relationships of organ structures, and liked being able to rotate the images, but were less impressed with graphics quality and the limitations to group interaction. Tutors felt well-prepared for using the tables but were frustrated by technical issues, and few thought the tables were a good investment.

Keywords: Anatomage undergraduate student engagement health sciences.

Background

A core unit for all Health Science courses at Curtin University, Human Structure and Function 100 (HSF100), ensures that students learn basic human biology across most body systems. Enrolments in HSF100 are large (around 2200 students in semester 1 and around 430 in semester 2 each year). Previously, human cadaver specimens were used for these classes but with increasing class sizes and demands on wet lab facilities for more specialised classes, an alternative learning resource was sought. Anatomage tables were incorporated into HSF100 classes for the first time in semester 1, 2013. Anatomage tables use digitized images in an interactive way to show the structures of the human body, and provide a large-scale "iPad-like" experience for collaborative learning in class. Different body systems such as the circulatory and gastro-intestinal systems can be selected and explored with touch-screen technology, but only one user can touch the screen at any one time. Both male and female body images can be rotated, virtually sectioned, and resized. In this study the male images were from CT scans so organs such as the liver showed full internal detail, whereas the female organs were computer-generated graphics that were very clear but empty of internal detail. Software updates will allow for more detailed images of internal organs and muscles for both image sets. HSF100 students have a weekly two-hour workshop facilitated by two tutors over the 12 week semester. Generally there are between 45 and 50 students in each class, and students work through various stations in groups of eight. The Anatomage tables were incorporated into 6 of the 12 weeks of HSF100 workshops. Although many have researched online anatomy resource use with students (Choudhury & Gouldsborough, 2012; Johnson, Palmer, Burton, & Brockhouse, 2013; Tworek, Jamniczky, Jacob, Hallgrímsson, & Wright, 2013) there is no literature reporting student or tutor responses to the incorporation of the Anatomage tables in face-to-face undergraduate classes.

Aims of the project

Major aims of the project were to;

1. Review the way in which Anatomage tables were incorporated into unit content and classrooms
2. Gather perceptions of students and tutors regarding their experience with the Anatomage tables.

Method

Data were collected from staff and student focus group transcripts, tutor and student surveys and classroom observation. An online survey was developed for both students and tutors and served using Qualtrics survey software. Students were asked to provide some basic demographic information, answer some questions about how they used technology for learning, and recall aspects of their experiences using the Anatomage table in HSF 100 classes. The tutors were asked about their teaching experience, preparedness for using the Anatomage table and their responses to using the tables. Three focus groups were conducted for tutors, and one semi-structured interview was conducted with the Unit Coordinator and her deputy. In-class interactions were observed using fixed camera video footage, and scored for student engagement.

Figure 1: Students using *Anatomage* in HSF100

Preliminary results

Response to the online student survey was 18% (n=326) with females making up 87% of the respondents. Most respondents had a smart phone with 15% of females and 10% of males using anatomy apps on their phone. Almost half had a tablet such as an iPad but few respondents reported using Anatomy apps to help them study HSF100, and only 7% used their tablet with anatomy apps in class.

Table 1 HFS100 Student technology use

Technology use by students % (n= 326)

Own a smart phone	90
Own a tablet	43
Used anatomy apps to help them study HSF100	20
Used tablet with anatomy apps in class	7

More students reported that using Anatomage was moderately or very helpful to them in understanding the relative sizes of different organs and the relationships between organs rather than helping them use correct anatomical terminology (Table 3) but students valued animations and videos available in the class models and plastinates more than the Anatomage tables (as shown in Table 2). Student respondents reported not having enough time to use the tables (70%) and problems with the table "freezing", being hard to control, having images of poor quality, and allowing only one person to interact with it at one time. On the positive side respondents reported that they liked the 3D aspect, seeing the sizes and relationships between organs, using the slice tool to see cross sections and not having to see wet specimens.

Table 2 Students evaluation of learning resources usefulness

Student evaluation of learning resources usefulness	%
Animation and videos	78
Models	62
Plastinates	60
Anatomage tables	36

Of the 32 tutors teaching the unit, 22 (69%) responded to the Qualtrics survey. About half of these respondents were experienced tutors with 5 or more years experience and two thirds of them (64%) had taught HSF 100 previously, using cadaver specimens. Most (73%) felt well prepared for using the Anatomage tables in class but only 9% said that it worked well for them every time they used it. They felt, like the students, that table was moderately or very helpful to the students in understanding the relative sizes of different organs rather than helping them use correct anatomical terminology, although they felt that Anatomage helped students understand relationships between organs (more than the students did, as shown in Table 3).

Table 3 Students' and tutors' views on usefulness of the Anatomage table (% moderately or very helpful)

	Students (n=326)	Tutors (n= 22)
Understanding the relative sizes of different organs	79.5	71.4
Understanding the relationships between organs	56.7	72.7
Helping use correct anatomical terminology	44	41

Some tutors welcomed being able to view the systems in isolation and show hard-to see structures such as lymphatic vessels with clarity. However, many tutors felt the ability to handle cadaver material allowed deeper learning opportunities, especially in regard to the range of variation.

Tutor focus group transcripts are yet to be analysed using NVivo, but trends are emerging. Tutors reported that, while the initial exposure to the Anatomage table engaged the students, this decreased as the semester progressed, and technical issues were hurdles in some classes. Some tutors reported that students' expectations of the quality of the graphics were unmet, but they enjoyed the dynamic aspects of the table, especially being able to slice and rotate sections. This feature, they believed, helped students consolidate learning around body planes and organ relationships. Some tutors welcomed the Anatomage tables as a replacement for human cadaver material that had disturbed some students to the detriment of their learning. However, few tutors thought it had been value for money.

The Unit Coordinator and her deputy reported trialing different amounts of direction for the students in the workshop notes for the Anatomage station. This they believed was of benefit to the tutors but my have discouraged exploration by the students. However, arranging pre-determined settings ("presets") of particular systems or image views saved time in class.

Discussion

Our results support the findings of Thompson (Thompson, 2013) that students classed as "digital natives", i.e. those who have grown up with digital technologies, are not using a raft of applications available to them on the digital devises they possess. Although the Unit Coordinator feared that using presets may discourage exploration it is possible that students would not necessarily do so if presets were not used. Students were critical of the quality of graphics in the Anatomage table, and some lost interest after the initial novelty wore off. Proportionally more males than females reported using computer applications for learning anatomy material, although this would have included units other than HSF100. Males may use more individual on-line study resources because they may be less likely to study in a group (Sanders et al., 2007).

Choudhury and Gouldsborough reported that students using on-line resources for the study of anatomical material missed the interaction of working in groups around a teaching resource (Choudhury & Gouldsborough, 2012), and this was a disadvantage mentioned by HSF100 students. Whereas a group of eight can effectively work around other resources such as a large model to explore different aspects, Anatomage only allows one user at a time, so eight students is too large a group around the Anatomage table for effective group processes to occur. While there is greater appeal in working on a larger scale with touch screen technology (Echtler & Wimmer, 2013; Hardy, 2012) multi-user capabilities are important to allow a more collaborative experience for learners. Johnson found that some on-line anatomy applications encourage individual work, and that students prefer to have a dialogue either with other students or with a tutor (Johnson et al., 2013).

Some of our results suggest conflicting views on the amount of direction, such as written questions or table presets, to give students at the station. Students and tutors found Anatomage of use in some syllabus areas such as organ scale and relationships, but less so in other areas, indicating that there may be particular contexts in which more direction in instructions to students is required.

Further work

Camera video will be analysed for engagement and interaction and the results compared with student and tutor responses to the survey. We will compare themes emerging from the student and the tutor data, and explore the apparently off-task behaviours (Judd & Kennedy, 2011) of students around the Anatomage table. Students entering the follow-on unit in their course will be asked about their reflections of what they learned from the Anatomage table, and further cohorts of students will be asked to assess themselves as "digital natives" or "digital emigrants" (Thompson, 2013). It would also be interesting to observe other aspects of the way in which students work with Anatomage, such as removing or clustering particular images (Hardy, 2012), or the order in which students browsed or followed specific prompts in their workshop notes.

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Second Life calling: language learners communicating virtually across the world

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Language learners are motivated to learn when they understand a given context and are able to relate to the authenticity of the situation. Many of these activities are traditionally achieved through role-playing. In Second Life (SL), people from different corners of the globe can participate in live, synchronous communication in a shared virtual space through their virtual representations or 'avatars'. One advantage of SL for such role-play is that the focus is on the avatar, not directly on the language learner. This paper reports the results from a pilot study conducted at a New Zealand polytechnic on the perceptions of learners of English using the multi-user virtual environment of Second Life to complement their learning.

Keywords: Second Life, CALL, role-plays, synchronous communication, collaborative learning

Introduction

Since the 1960s, computer technology has played an increasingly significant role in the learning and teaching of languages. Computer Assisted Language Learning (CALL) has been an area specialising in developing and delivering methods that enable learners and educators to access language learning via this technology. CALL is described (Hubbard, 2009) as a constantly-changing field, where the technology used may improve the conditions in which language learning and practice take place, hence improving learner motivation. However, Hubbard also points out that, as it involves the use of relatively new and not fully trialled technologies, CALL may be unpredictable and time-consuming.

The advent of technology in computer assisted language learning (CALL) has contributed greatly to the field of language-learning and -teaching worldwide. This is particularly evident in the developments seen in computer-mediated communication (CMC) and computer-supported collaborative learning (CSCL) technologies, which "involve every language skill and area including speaking and listening skills" (Ciekanski and Chanier (2008) cited in Deutschmann et al. 2009). The Internet continues to be instrumental in facilitating global connections and collaboration between people through improved network infrastructure, greater connection speed and Web 2.0 technologies (Frias et al, 2011; Peachey, 2010). The growth in the availability and use of Web 2.0 tools, in particular, "can provide language learners with meaningful opportunities to engage in multiple literacy practices and to construct learner identities through interactive activities in virtual communities" (Wang, C X et al., 2009 p 2).

This paper reports on a pilot study undertaken to explore the perceptions of learners of English as an Additional Language (EAL) using an Internet-enabled multi-user virtual environment (MUVE) Second Life (SL). This is considered to be a relatively new technology in CMC, and it is acknowledged in the current literature that there needs to be more research into the use and benefits of MUVEs in Second Language Acquisition (SLA) (Wong, 2011; Deutschmann et al. 2009; Henderson, 2010; Wu, 2012). This study aims to contribute to a wider understanding of the current use of SL by EAL learners as a platform to promote interaction between users in order to improve their English language skills.

Learning languages in virtual worlds

One of the facets of language and language learning is the need to communicate. The benefit of a meaningful conversation in authentic situations is invaluable to language learners (Warschauer & Meskill, 2000; Krashen, 2003). However, it is not always feasible to 'create' these situations, especially in a classroom environment. Second Life provides a platform where language learners can meet and hold conversations in a multimedia-rich environment, giving the participants a sense of 'being there'. Two characteristics of a conversation in SL, which together create a unique experience, are the use of avatars and the immersive nature of the environment in which they interact. The avatar, a visual representation of the learner, is defined as "the bodily manifestation of one's self in the context of a 3D virtual world" (Savin-Baden, 2010). While the avatar is still operated and controlled by the learner, the focus shifts from the real person to the avatar, allowing the language learner to speak without 'losing face' (Wu, 2012).

Virtual worlds can provide visual stimulation in a way that is not feasible in an ordinary classroom. Learners can immerse themselves in an environment that is built by other users for the purposes of replicating an original location. Therefore, English learners can find themselves catching a double-decker bus to the British Museum without having to leave their homes. Field trips are important in language learning, but the time and cost involved in arranging them is often prohibitive. However, a virtual environment like Second Life can be used to create an immersive and authentic learning environment relatively cheaply and quickly. The virtual environment is also conducive to social and collaborative learning, as communication takes place via problem-solving and co-creating. According to Wu, "when they [learners] learned about body parts in English classes, they can only remember the basic vocabulary such as nose, face, eyebrows, etc. However, when they were making changes to their avatar, they grasped more words such as hairline, skull, and pupil..." (2012 p.5).

Autonomous learning is paramount in second language acquisition (Hourigan & Murray, 2010; McLoughlin & Lee, 2010). If learners gain confidence in approaching fluent speakers of the target language in a virtual environment, they are more likely to approach them in real life situations. SL can provide the medium where language drills, prepared discussions, and even open-ended topics are tackled in as 'realistic' a manner as possible without the complications that real-life situations could impose on the learner. The environment in which language learners interact may lead to increased participation, as they are 'hiding behind their avatars' and are immersed in 'simulated situations for real-life association' (Peterson, 2010; Deutschmann et al. 2009). This concept of anonymity is raised by Wong (2011) and Wu (2012); they highlight the reluctance of learner participation due to 'losing face' when speaking English. The support gained from online peers in assisting with the use of the technology may also encourage learner-centred, problem-solving interaction in SL.

Despite the above positive perceptions of SL, Knutzen & Kennedy (2012) point out a limitation - the time zone difference for synchronous voice chats. Their research investigates a collaboration pilot project between a university in Hong Kong, China and Texas, USA. They recommend that institutions planning to collaborate on Teaching English to Speakers of Other Languages (TESOL) instruction should ideally do so in more compatible time zones, such as Australia and New Zealand. An alternative to interacting in SL is suggested by Wang & Shao (2012) if technical obstacles arise. Their research included activities involving reading and translating SL's official web site to gain insight into the virtual environment. The outcome was increased motivation to participate in SL due to its visual attraction and game-like environment.

Research Design

This research was prompted by a desire to investigate the following questions: What are the student perceptions of SL as a tool to practise English language skills? How can these perceptions be integrated into and utilised by language teaching methods? These questions arose from the following observations:

- finding language exchange partners is difficult to organise and maintain
- language practice out of class time is limited
- encouraging learners to be more independent and autonomous is a difficult task, both for the teachers and the students
- access to good materials for discussion can be limited

Consequently, the current research, of which this pilot is a part, aims to investigate the initial and ongoing perceptions of language learners using Second Life, and to identify those aspects of a virtual environment that can be leveraged to encourage autonomous language learning.

This study aims to investigate whether language learners perceived value in their Second Life experiences. In particular, it was expected that it would highlight certain aspects such as the value of having access to a widely accessible and authentic learning space providing speakers and thereby providing richer opportunities to practise the target language. It was also expected that learners would enjoy a setting that protected them from the embarrassment or loss of face that can come from classroom-based activities, and that educators would welcome the opportunity to refine their teaching strategies.

Participants and Data Collection

This pilot study collected data from three distinct groups of participants:

a) English language learners at intermediate or advanced level, corresponding to IELTS levels 4 to 9, and who were regular users of Second Life (three such learners were interviewed in-world about how they perceived their language learning to be enhanced by the use of SL);

b) twelve international students studying English in New Zealand and participating in both real life and Second Life activities (their pair and group discussions in the form of open-ended questions were observed both in class and in-world);

c) intermediate and advanced language learners from the *Cypris Chat* and *Virtlantis* SL groups were surveyed via a questionnaire (available at http://bit.ly/1harI2I) (fifteen responses were received).

Findings & Discussion

Once the data had been collected, it was analysed to identify the major themes that emerged. These themes, which are discussed below, were: immediate feedback, immersive environment, role-playing, community of practice and anonymity. Comments taken from student feedback are shown in italics.

Immediate feedback

One of the recurring themes was the presence or availability of a 'teacher' in SL. This could be an English language tutor, or a near-native speaker of English, who was willing to listen to the conversations and provide instructive feedback. In many cases, the learners' only access to another English speaker was via the Internet:
"No teachers but - volunteers/native speakers provides us those chances and it's much easier for me to attend"
Despite the lack of highly structured lessons in SL, the learners enjoyed interaction with other 'avatars', and found their immediate feedback invaluable. The conversation took the form of discussing topics that were initiated by the avatars, or suggested by the organisers in-world. The language difficulties were resolved as the communication proceeded. Some learners preferred written text, as they were able to process the information. Others felt comfortable enough to have the conversation live, with the use of a headset and microphone.

Immersive environment

Another significant aspect of SL is its immersive quality, where the learners (avatars) are in a location, or at least looking at one on a computer monitor. The ability to visualize the environment in which a learner interacts provides a 'buffer' zone to collect one's thoughts and ideas to produce the necessary appropriate language, especially in the context of subliminal learning:
"...but i wanna say that when i came to sl it was into really for learning here everybody speaks english so i started chatting in english "
"After two years I discovered English learning sims...I started voicing...Here they have activities not really classes...where you can practise speaking...it's a great opportunity and it's all for free so why not learn? Some of the stuff we have here in SL for free can cost a lot of money in real life you know"

Role-playing

Role-plays are used to set the scene for a particular language unit. It is often the concept that needs to be conveyed to the learner. Once that is achieved, the learner then practises mostly by repeating the language that is introduced. The process of 'acting it out' makes the situation realistic: *'the main reason for me to come here I can use my English actually by using voice...I don't have this type of chance in my real life in Japan. So even though I try to learn English by listening or reading but no chance to use actually so it's really good to know how much I can use'*

The Community of Practice

Community of practice in SL is paramount. Collaboration amongst the language learners, volunteering tutors and/or near-native speakers, is highly valued and regularly practised. This encourages autonomous learning, with the most valuable resource being the *other* avatars. *'This is like an English world with all the people knowing that you are learning... you're still learning...They don't expect you to be perfect and this is very* *important...you just talk and it's ok to make mistakes...it's ok to find difficulty in trying to find a certain expression...so you feel comfortable...you don't feel like pressured or stressed...and then you speak naturally"*

Anonymity

Anonymity is another important characteristic of SL, as building relationships with other avatars encourages learners to practise their skills in a more relaxed manner: *"We need to be careful but once I get to know people...we share real life stuff and we become friends in Facebook etc...I mean they become like a part of us...I have some friends I have never seen them but I wish one day I can get a chance to see them in real life"*

Recommendations for educators

The potential of Second Life lies primarily in the language exchange opportunities facilitated by its immersive environment and its well-established global community of language learners and educators. The volunteers benefit reciprocally from interacting with each other, as each party can contribute to, and receive, something valuable from the exchange. Collaboration among volunteers is important for the exchange of technical, pedagogical and social expertise. Educators should be on the lookout for existing resources as there may be an expanding pool of resources that educators can make use of, including set activities for language learning purposes. Engaged students are better learners. Therefore, tasks with clear aims should lead the sessions in SL. Like any other learning environment, ongoing feedback should be sought from the learners to gauge their level of skills, interest and capability to use the technology. The integration of new technologies into current curriculum areas, rather than researched separately, is necessary to overcome any possible barriers, especially technological ones. Another area of research could be the investigation of the perceptions of EAL tutors. The field of professional development and training, especially for those new to the profession, may be a good starting point to introduce language educators to virtual worlds.

Conclusion & Future Work

Language learners, by definition, have to communicate. If an immersive environment is provided, in the company of like-minded people with similar needs (in terms of learning and practising additional languages), an optimal situation is created for informal learning. This, together with useful materials and resources, and volunteer teachers, creates an environment providing ample opportunities for both formal and informal language practice. The learners can guide each other and take ownership of their learning, creating a 'learning moment' when it suits them. The role of the educator remains that of assessor and facilitator in this environment. Once the credibility of the 'teacher' is established, the activities take place as though the parties were in a face to face situation in a classroom. This is similar to 'traditional' classroom teaching where the teacher tries to build a good rapport with students to gain their trust. However, in a virtual environment, the roles may at times be reversed as some learners of language may be expert users of the technology – a situation which is empowering for the students, as they use their new language skills to help their peers and communicate with their teacher. Our pilot study indicates that the use of Second Life, a virtual environment, can assist language learners by providing a virtual classroom at times convenient to them. The notion of having a real person to talk to, in the form of an avatar, in a location that virtually replicates an authentic situation, provides useful opportunities for autonomous language learning. Within the virtual space, the difficulties of communication can be negotiated and resolved, hence facilitating the use of new language skills in a real-life situation. Learners are empowered by having the freedom to participate in a language community when and where they choose, guided and inspired by educators taking a facilitation role rather than an instructional role. This study suggests the use of multi-user virtual environments is a beneficial adjunct to classroom-based language learning, and research is planned to investigate this further.

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Machinima for immersive and authentic learning in higher education

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The use of virtual worlds have been well documented as a space for immersive participation by students when learning authentic tasks that can be difficult, if not impossible, to undertake in the real world. They have also been used in order to grasp important concepts through machinima (inworld video). A pilot project, "computers@armidale", explores the use of machinima to explain important concepts in a first year accountancy degree. Often, these concepts are difficult to grasp without taking students through authentic learning tasks. This paper describes the learning concept, the creation of the machinima and how it is used with first year accountancy students through a think out loud protocol.

Keywords: Accounting, virtual worlds, machinima, think out loud protocol

Introduction

Machinima (video created from scenarios acted by avatars in a virtual world) has been used for several years by higher educational institutions to demonstrate procedures, explain concepts, and generally creating learning materials that were resource and budgetary friendly. Creating machinima only requires a few people who control the avatars acting out scenarios, plus someone to record, edit and upload the video. These can often be the same one or two people. Real life video is much more demanding regarding resources and money. Producers, actors, cameras, sound recording equipment, editors and locations are all required for video that is made with real people and in the real world. Machinima is a cost effective way to teach students and, on occasion, the only way to teach students when the creation of the videos is not viable in real life due to monetary or physical constraints.

Background and Overview

A traditional university, the University of New England (UNE), consists of both on-campus and off-campus students. On-campus students live in on-campus accommodation, within the city or close proximity, attending face-to-face lectures and tutorials, using a Learning Management System (LMS) to access supplementary study materials and resources. Off-campus students live anywhere in the world and the LMS provides all their study materials and resources. A range of online tools such as discussion boards, chat rooms, quizzes, videos and downloadable documents are provided through the LMS.

The use of virtual worlds for teaching and learning has been utilised at UNE since 2008. In the School of Education, role-plays, excursions, guest lectures, and the use of machinima are just some of the ways in which a virtual world has been used for teaching and learning. In 2012, the Bachelor of Pharmacy course began using machinima to teach students concepts that were difficult to replicate in real life teaching scenarios (see Gregory et al., 2011). In 2013, the UNE Business School began using machinima to teach concepts that are difficult to comprehend through traditional methods using textbooks. Machinima has been created to demonstrate scenarios in which the accounting concepts are replicated from real life business. This paper reports on a pilot study to determine the authenticity and appropriateness of using machinima to teach basic accounting principles to first year students. To simultaneously identify the benefits of the machinima and improve student learning outcomes two enhancements will be added to the next phase of the project. These are the use of think out loud protocols and the Moodle Lesson tool.

Literature Review

Filimon (2009) defines machinima as computer-animated films that combine machine, animation and cinema, filmed in a virtual world to be distributed online. They are used by educators as there are often limitations of traditional delivery modes (Muldoon & Kofoed, 2009) and it is often impractical to create a video in real life due to the cost of production, that it could harm real people, or that it is actually impossible to replicate in real life. Machinima provides an avenue to learn in authentic environments where there is increased levels of engagement and active learning (Muldoon & Kofoed, 2011; Muldoon & Kofoed, 2009). Machinima can influence the "genre, point of view, perspective, set, lighting, characters and objects" (Filimon, 2009, p. 397). It is influenced by the virtual world that it is created in.

Understanding the fundamental basic accounting principles has often been difficult for students. If they do not understand these basic principles, it is difficult for students to progress with their studies and apply their knowledge in the real world. As Muldoon and Kofoed (2011, p. 419) point out, there has been a "long-standing educational problem in accounting education of failing to help students to achieve higher order outcomes" and the traditional delivery mode is a limiting factor. Machinima is a step towards alleviating this problem. There is a small minority of accounting educators using machinima as a teaching and learning tool (Muldoon & Kofoed, 2009). Machinima provides students with the opportunity to adapt to new situations by engaging students in accounting practice and developing skills required for the profession (Muldoon & Kofoed, 2009). As Muldoon and Kofoed (2009) state that often, graduate accountants become technically proficient but find it difficult integrating rule-based knowledge with real world problems and applying their knowledge to real situations.

If students are provided with a spark, their curiosity will enable them to learn with limited assistance (Robinson, 2013). Education is about learning and is an innovative profession where machinima can provide this creativity. Educators who inspire students to learn are mentors who stimulate, provoke and engage students. By creating a meaningful and motivating context for learning, students are provided with a motivating and challenging learning environment so they can see the worth of what they are learning (Muldoon & Kofoed, 2009). Testing is also important but exams should not be the dominant feature, they should assist in learning. Assessment should support learning, not obstruct. The think out loud protocol engages the student in an intense interview with an expert (Olson & Rueter, 1987). This can be a form of assessment, or merely a way in which to gain information on a student's understanding of concepts. Drennan (2003, p. 59) describes the process where an interviewer (educator) asks the student "to think out loud as they go through a questionnaire and tell them everything they are thinking, with the interviewer asking probing questions of the respondent to find out their thoughts". The think out loud protocol is used in this pilot study so that students can articulate the learning that they have experienced through the use of computers@armidale machinima.

The use of machinima through the 'think out loud' interviewing process can assist students in this learning to gain insight into the cognitive processes (Drennan, 2003). This metacognitive control enables the students to direct the reasoning process (Duffy, Roehler, & Herrmann, 1988). It makes "visible invisible mental processes" (p. 675). This process must provide opportunities for students to express their thoughts and opinions. However, Drennan (2003) states that this can be problematic as students may not be able to articulate their thoughts and it may affect their thought processes, it also provides a distraction and can be subjective.

Pilot Study: Conceptualising and creating computers@armidale machinima

A pilot study called computers@armidale was undertaken in 2013 where machinima was created to support student learning through a practice set. This practice set was trialed with academics and students in the accounting discipline. A practice set is one of the key learning opportunities in the unit. It is an attempt to replicate what happens in practice. Students are provided with financial reports for the beginning of a period, proforma accounting records and a list of transactions and other events. Based on this information they are required to work through the steps in the accounting cycle so as to prepare the financial statements and then analyse the performance of the business.

While the machinima could potentially suit a wide range of accounting tasks, it will be used initially to replicate the recording of transactions and the posting of those transactions to the various ledgers. The potential difficulties are that the machinima needs to be used judiciously because they do take longer to watch and replicate as they are covering the full context. While this is clearly beneficial for students who have not had exposure to business and are having trouble comprehending these concepts, it does not necessarily provide added value for students with certain types of work experience or who adapt quickly to this type of material.

Students that have some work experience are at a significant advantage in working on the practice set and accounting in general because they have opportunity to better visualise what is going on behind the transaction. One option to help students, and particularly those with little or no work experience, would be to take them on a field trip to watch a stocktake, observe an actual sale, and see what happens in order to make visible all of the changes that have occurred. (For instance, when a credit sale is made, not only do we need to record the sale and recognise any Goods and Services Tax (GST) collected, we need to record that our accounts receivable has increased, update our accounts receivable subsidiary ledger, and we also need to record the reduction in stock levels and recognise the cost of the goods sold). However, this is neither cost effective nor practical. Indeed, for off campus students it is generally not possible. A cost effective and practical substitute for the field trip is producing a set of machinima that highlights the process and what is involved.

The first machinima (see http://www.youtube.com/watch?v=PDY9KiTzcPk) opens as a stocktake and is completed in the retail business computers@armidale. The first image (Figure 1) shows the two shop employee avatars completing the stocktake. A customer then enters (see the second image) to purchase 15 computers on credit. This provides the vehicle to examine how this transaction will be recorded in the various accounting records.

Figure 1: Screen shots of accounting machinima used in the research (i.e., still shots from the machinima)

The use of a fictional character, such as Fred Flintstone, enables the students to easily differentiate between the characters – shop owners and customers. Once students had viewed the machinima, the students were invited to participate in the think out loud protocol. The results of the think out loud protocol are not reported in this paper.

Future Directions and Conclusions

This paper describes a concept that has been introduced in an introductory accounting unit. An initial machinima has been created that follows through one transaction. Student results in related quizzes are higher than equivalent results in previous offerings of the unit, however a number of enhancements have been added to the unit and these results do not signpost the cause of the improvement. The enhancements are in two key areas – providing rapid and targeted feedback to students and employing some basic ideas from gamification. The feedback relates to online quizzes and instant feedback. Scaffolded quizzes and the results from those quizzes are used to direct students to targeted resources. As well, there are practice set enhancements including instant marking of all answers, and the provision of a student dashboard to report on their progress and inclusion of leaderboard on the Moodle website to highlight the highest performing students.

In testing how people used the machinima, it was revealed that while the video was valuable to people that watched it, people did get different things from the one video. As a result, two enhancements were planned for the project.

1. Using think out loud protocols to help understand what is really happening inside a student's head as they engage in accounting activities that are new to them; and,
2. Using the Lesson Tool in Moodle to test students on what they have learned during each segment of the video and if there are things unlearned from the segment they have been tested on, they are then diverted back to cover those sections again in the video.

These enhancements will not only help pinpoint the contribution of the machinima but are also likely to enhance the student learning experience.

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Virtual worlds in Australian and New Zealand higher education: Remembering the past, understanding the present and imagining the future

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3D virtual reality, including the current generation of multi-user virtual worlds, has had a long history of use in education and training, and it experienced a surge of renewed interest with the advent of Second Life in 2003. What followed shortly after were several years marked by considerable hype around the use of virtual worlds for teaching, learning and research in higher education. For the moment, uptake of the technology seems to have plateaued, with academics either maintaining the status quo and continuing to use virtual worlds as they have previously done or choosing to opt out altogether. This paper presents a brief review of the use of virtual worlds in the Australian and New Zealand higher education sector in the past and reports on its use in the sector at the present time, based on input from members of the Australian and New Zealand Virtual Worlds Working Group. It then adopts a forward-looking perspective amid the current climate of uncertainty, musing on future directions and offering suggestions for potential new applications in light of recent technological developments and innovations in the area.

Keywords: virtual worlds, 3D multi-user virtual environments, simulation, gamification, augmented reality, natural interfaces

Introduction and background

Higher education institutions across Australia and New Zealand have been utilising the affordances of 3D virtual worlds (VW) for research, teaching and learning for a number of years, some since as early as 1979 (Gregory et al., 2012). The Australian and New Zealand Virtual Worlds Working Group (VWWG), to which the authors of this paper belong, was established in 2009 and consists of almost 200 educators, educational designers/developers and researchers with a diverse interest in VWs. Almost all of the universities in the two countries, a number of Australian TAFE institutions and private higher education providers as well as several New Zealand polytechnics and institutes of technology are represented in the membership of the VWWG.

A variety of VW platforms have been used across the institutions but the majority have been using Second Life (SL), OpenSim and, more recently, Unity3D, Jibe and Minecraft. The background of some of the institutions will be discussed in relation to their use of VWs for learning and teaching, placing the reader in context. Firstly, a short literature review provides an overview of the use of VWs in higher education institutions. The following section discusses how VWs have been used in the past at authors' institutions. The next section provides an understanding of the present and finally imagining the future with some concluding remarks in relation to VWs, past, present and future. Thirty-two members of the VWWG from 18 Australian and New Zealand institutions responded to a survey requesting information about the trends affecting VWs at their institution. Thirty-four members responded to a request on how they were using VWs in the past, present and future. Their responses are outlined in this paper. Overall, 52 authors have contributed to the discussion in this paper.

Literature Review

In the early 1980s virtual reality emerged as an innovative technology that changed the way we interact with a computer. Immersion in an environment was assisted by the ability to move and view in three dimensions (3D) within the environment and by the use of synchronous communication with other users. The increase in access to both higher capacity computer hardware (storage, graphics and memory) and higher speed connectivity to the Internet has facilitated the ability to connect to work, study and entertainment anywhere, anytime, using 3D multi-user virtual environments. In our discussion, we define a VW as a computer-based, immersive, 3D multi-user environment that simulates real (or imaginary) life, experienced through a graphical representation of the user.

A great deal of literature has emerged in the past 20 years in relation to the potential strengths and learning benefits associated with the pedagogical use of VWs (see, for example, Dalgarno & Lee, 2010; Hew & Cheung, 2010; Mikropoulos & Natsis, 2011; Wang & Burton, 2012). Many educators have seen the potential for VWs and have pursued their use in higher education. For the past three years the VWWG has documented the use of VWs in higher education in Australia and New Zealand (Gregory et al., 2010, 2011b, 2012; Hearns, 2011). In this paper we continue to describe what universities are doing and also consider where they are going. A strong message from the literature is the need for sound learning design and pedagogy that fully utilises the potential of the VW (Dalgarno & Lee, 2010; Mikropoulos & Natsis, 2011; Salmon, 2009; Savin-Baden et al., 2010). There is also some way to go in the areas of IT management and logistics of VWs, not to mention user literacy (Dudeney & Ramsay, 2009; McDonald, Ryan et al., 2012). Despite the existence of VWs over a significant period of time we are perhaps still in an exploratory phase as we are mapping out best practice often without institutional support, resulting in an approach that is less than systematic. Salmon (2009, p. 526) suggests, "we need much stronger visions to help us get ready to point the way to evidence based research, rather than merely 'reacting'." Collins (2008, p. 60) also advocates an imaginative approach to reframing the way we think and talk about VWs, that they are more of "an exciting new laboratory" or "a giant sandbox" rather than a "technology application". VWs are a way to step into our collective imaginations in a manner that we have never been able to do before. In this paper, the authors combine their analysis of emerging trends and developments with their imaginations to collectively envision the future for VWs in education.

Remembering the past

In this paper twenty-nine institutions from the VWWG come together to discuss the context of teaching, learning and research in a VW from either their personal and/or institution's point of view. When exploring joint papers presented by VWWG at ascilite over the past three years (see Gregory et al., 2010, 2011, 2012), it can be seen there has been much hype around the use of VWs for teaching, learning and research. However, this initial exuberance has subsided and been replaced with a more pragmatic approach to their use. At this point it appears that higher education institutions are either opting out of using VWs, or are continuing on a "business as usual" path with very few opting for large new initiatives. Those that continue to utilise VWs do so either having already decided to centrally support an institutional VW presence, some at reduced levels or are continuing to use VWs in a limited capacity, typically relying on the efforts of individuals or small teaching teams. In a number of cases the reliance on a few key individual champions has meant that when those individuals move on, the use of VWs diminishes considerably or ceases in their institution; too often this occurs without a digital preservation strategy in place resulting in resources being lost to the community.

Understanding the present

VWs provide a highly flexible and engaging facility for students and staff to build scenarios and simulations, virtual meeting places and a platform to investigate how online virtual environments can meet teaching and learning needs into the future. The diverse and active communities in VWs and the incredible range of resources available keep many institutions active in their research, teaching and learning in VWs. There remains much enthusiasm on the use of VWs amongst the VW educational community but issues such as bandwidth availability for students, institutional infrastructure and support blockages, the reliance on specialist skills needed to use VW educational development tools, the sharing of innovations and awareness of the capabilities of VWs in the general academic population are still barriers at many institutions that need to be overcome before wider adoption can be achieved.

Many academics continue to teach because of the pedagogical advantages afforded by these environments (both for on-campus and off-campus learners) and because of the learning opportunities that might not exist or be possible in other environments. They also recognise new learning opportunities that arise as the technology behind the VW environments improves and the technology that gives users access to the environment improves (e.g. NBN, tablets, smartphones, etc.). They continue to research because learning in these environments (as in many environments) provides opportunities for research; some of these opportunities are unique to the environments; these environments facilitate the collection of data in ways that might not be available in other environments; and, comparisons of the same learning related phenomenon can be made between VW environments and other environments which may highlight aspects that would not necessarily be obvious without such comparison.

Table 1 outlines the way in which VWs are currently being used at each of the 19 institutions surveyed for this paper. The table details how the technology is supported (whether on an ad-hoc basis through the efforts of individual academics or teaching teams, often funded by grants, or through centralised institutional funding and support), the VW used, the disciplines that are using VWs and the nature of the use at each institution. SL is still the most common VW in use (15 of the 19 institutions), however it remains the sole VW at only 5 institutions. Alternatives are on the rise with approximately half (10) of the institutions using OpenSim (an open source equivalent of SL that can be installed on an institutions' server, individual PCs or on USB devices) and eight institutions are using Unity3D. Other VWs used include Sim-on-a-Stick (SoaS – a VW wholly contained and usable on a USB thumb drive), Jibe or Kitely being used at one institution each with two trialling Minecraft. There is much experimentation being undertaken to find the "right" VW for the various institutions' requirements. Custom developed VW systems are in a tiny minority with the majority still looking to readily available platforms.

Institutions are using VWs for a variety of research, learning and teaching activities. The 19 surveyed institutions reported activities being undertaken that include: role play activities (9); machinima (video captured from within a VW) (4), virtual tours (5); PhD students (2); staff or faculty development (2); careers services (2); institutional marketing (2); and, although not reported in the table, all institutions are using VWs for research, collaboration and communication. Individuals also reported that VWs are being used for scenarios that aim to develop a range of employability or "soft" skills. Table 1 summarises these findings.

Table 1: Summary of institutional use of virtual worlds

Institution and *Support Basis (Central support or ad-hoc use)*	**3D virtual world used**	**Disciplines**	**Nature of use**
Curtin University *Ad-hoc*	SL, OpenSim, Unity3D, Minecraft, Augmented Reality	Business, Physics, Building, Health Sciences, Logistics and Supply Chain	Trials, simulations, student activities, projects, retention.
Griffith University *Ad-hoc*	Unity3D, Minecraft, SL, OpenSim, Cloud Party	Education	Simulations, machinima, tours, demonstrations and student projects/builds.
James Cook University *Ad-hoc*	OpenSim, Unity3D	Health	Demonstrations
Manukau Institute of Technology *Central support*	SL, OpenSim	Foundation Studies, Language Literacy and Numeracy, Language Culture and History	Interactive demonstrations, tours, group activity, guest speakers, student activities, game based activities, simulation and role play.
Monash University *Local support/Ad-hoc*	SL, Unity3D	Languages, Pharmacy, Orientation, Outreach	Student activities, role play, low-level AI, virtual tableting facility, process simulation, campus orientation and exhibitions.
Nelson Marlborough Institute of Technology *Central support*	SL, OpenSim, Kitely	Languages	Student activities, group work, collaboration and projects.
Queensland University of Technology *Central support*	SL	Law, Education, Marketing	Machinima for demonstrations and scenario, tours and marketing.
RMIT University *Ad-hoc*	SL	Health Science, Medicine	Role-play and group activities.
Southern Cross University *Central support/Ad-hoc*	SL, OpenSim, SoaS	Nursing, Business, Education, Building	Student created resources for teaching. Design analysis and critical evaluation.
University of Ballarat *Central support*	SL	Science, Information Technology, Nursing, Engineering, Marketing	Demonstrations, marketing, support environments, role play, collaboration and cooperation.

University of New England *Ad-hoc*	SL	Education, Pharmacy, Accounting	Show, practice examples, role play, guest lectures, virtual tours, PhD, research, machinima and meetings.
University of Otago *Central support*	OpenSim	Medical Education	Role play (clinical decision-making and peer assessment).
The University of Queensland *Central support/Ad-hoc*	SL, OpenSim, Unity3D, Custom-platform	Faculty Development, Education, Pharmacy, Statistics, Health	Faculty development, PhD research space, virtual compounding dispensary and student activities.
University of South Australia *Central support*	OpenSim, SL	Careers	Services, resource delivery, virtual site visits, scenarios, role play, soft skill development and careers.
University of Southern Queensland *Ad-hoc*	SL, Jibe	Careers	Virtual career fair, machinima and demonstrations.
The University of Western Australia *Local Support/Ad-hoc*	SL	Art and Film, Anatomy, Physiology, Human Biology, Education, Outreach	Demonstrations, student activity, simulations, public exhibitions, competitions, education outreach, demonstrations and machinima.
University of Wollongong *Local Support/Ad-hoc*	Unity3D	Nursing	Role play and scenarios.
Victoria University *Ad-hoc*	Unity3D	TAFE Construction, Biotechnology, Engineering	Role play, simulation, tours and embedded energy efficiency calculators.
University of Western Sydney *Central Support*	SL, OpenSim, Unity3D, iClone, Augmented Reality	Computing and ICT, Industrial Design, Digital Humanities, e-Health and Health Sciences, Linguistics	Immersive simulation environments for research and teaching, student created resources, augmented reality and robot integration.

Offline, standalone VWs such as SoaS are not affected by bandwidth, with use at a number of primary schools showing the ability to offer least some of the same pedagogical goals as online VWs. The current trend towards browser-based access to VWs makes it easier for staff and students to access VWs directly, which bring role play and machinima for distance education students into reach. Machinima is being used to contextualise otherwise abstract concepts and principles. Intranet versions of VW servers make the development of internal secure grids possible. Mobile VW clients, to facilitate ad hoc, ubiquitous usages of VWs in educational scenarios are another area that is seeing an increase in use.

VWs are being used to cater for large numbers of students seeking an education while struggling with work and family constraints. The utilisation of VWs enables groups of students removed from the campus to work in collaboration on projects that enhance their learning experiences. They enable lecturers to provide activities that would be impossible in the real world with the current economic constraints imposed on tertiary institutions.

Research in VWs is being encouraged at some institutions, particularly in areas that will lead to improved retention and success of students. Universities need to create a supportive environment for the development of a wide range of virtual learning environments in terms of policy, the academic environment, practical support (particularly in relation to computing) and networking infrastructure and preservation.

VWs, 3D virtual environments and simulations have now been embedded in a number of institutions. While not widely used across all disciplinary areas, it is likely that their use will continue to grow and develop over time, although their growth is more likely to be driven by individuals rather than the collective institution. On the other hand, the novelty of using VWs for learning and teaching has worn off for some, as has the momentum, particularly given advances in cloud computing and the use of tablet technologies which increasingly promise to streamline core curriculum delivery.

Could it be that we are at a cross roads, perhaps at the point at which WV technology stops being an "emerging" technology and moves to more mature level? While the initial exuberance and hype surrounding VWs like SL has passed, the underlying platforms on which it is built, along with 3D engines like Unity3D are now relatively stable and mature technologies that allow a range of VW environments to be built and used. However, the future is anything but set and we will continue to see research into the use of VW platforms as educators search for the right platform to meet their specific needs and seek to incorporate the emerging technologies of the future.

Imagining the future

The authors, all experts in the use of VWs for research, teaching and learning, take on the challenge of imagining how VWs will be used in the future. The following section features some of the ideas that emerged as a result of a Delphi like process used by the authors. This first involved an online survey of the group which was then followed up with iterative editing cycles to arrive at the headings below.

Increase in the fidelity and realism of virtual worlds

VWs will continue to improve in quality, leading to even greater levels of visual, auditory and other sensory immersion, opening the door to greater opportunities for authentic learning.

Increase in fidelity and quality
Over time, VWs will improve in terms of the fidelity with which they are able to simulate aspects of the real world and the quality of the user experience that they are able to deliver. While VW platforms increase in their efficiency to display more detail with less data, the bandwidth demands are likely continue as more is expected. Bandwidth and technological issues may no longer be an obstacle to accessing VWs for many in Australia if the NBN lives up to its promise while others may be increasingly left behind. Software platforms, available Internet bandwidth and end-user hardware will provide even greater levels of immersive fidelity, flexibility of design (environment, pedagogy, tasks) and use, and acceptance by learners. VWs will have caught up to the look and feel and overall quality of more advanced video games and therefore better accepted by all stakeholders as a pedagogical alternative. They will increasingly come closer to the (positive) image of the virtual environment outlined in the book, Snow Crash (Stephenson, 1992). As a result there will be much more interactivity between stakeholder avatars and greater opportunity for creativity. There will be a single avatar, with one inventory for just one life that goes across all platforms. There will be a consolidation in the number of VW platforms.

Voice/text
Voice and text communications will be improved to appear in line with face-to-face communication. Lip-syncing will be enhanced and facial expressions replicated. VW technology has already moved some way towards being able to achieve this at present with reasonably accurate lip-syncing being available.

Blurring of boundaries between the real and the virtual

The increase in the fidelity of virtual VWs themselves will also need to be matched by increases in the ability for people to interact with them in more realistic ways. Currently, most VWs do not keep up with the variety of input and display technology that is available. VWs are intended to be immersive but many still rely on keyboard, mouse and 2D monitors placed on desktops as their interface. Future VWs will need to break down these barriers in order to enable a truly interactive, immersive and mobile experience by taking advantage of the full range of devices and approaches that are available. The availability of VWs through a multiplicity of interaction devices and mobile computing platforms will blur the boundary between the VW and the real world. Metaverse roadmap suggests we think of the future of VWs "not as virtual space but as the junction or nexus of our physical and virtual worlds" (Smart, Cascio & Paffendorfs, 2007, p. 4).

Mobility
Mobility will increase in terms of options for user access. Mobile technologies featured prominently in the recent NMC reports for Australia and New Zealand and are consistently listed as being on the immediate, short-term (one year or less) horizon (Johnson et al., 2010, 2011, 2012, 2013). VWs increasingly work across platforms including mobile devices such as tablets and phones with increasing ease as the capabilities of the mobile devices improve and the capacity of mobile networks to which these devices are connected increase. Quick Response (QR) codes are already being used to facilitate easy access to particular locations and objects within a VW using mobile devices. These are two-dimensional barcodes that can be photographed using the camera of a mobile phone or similar device as an alternative to typing a URL. New devices such as Google Glass will facilitate even greater mobile access and given the augmented reality style interface that is within the regular field of vision of the user, this will lead to VW access being available at anytime, in any place. Such a confluence of technologies should mean that for those with access to the devices and networks, access/usability issues would be greatly reduced over time.

Rich and intelligent blended learning
The fusion of virtual worlds and artificial intelligence will continue to provide authentic augmented environments tailored for specific pedagogical strategies. The resulting technology supports the integration of contemporary e-research and blended learning, for example in the area of digital humanities (Bogdanovych et al., 2012). Specialised artificial intelligence techniques will provide the authenticity of the look and behaviour of

the populations in these environments. For instance, virtual cities can be populated with diverse crowds of virtual agents that genetically preserve their ethnic features through the generations (Trescak et al., 2012).

Augmented reality

Augmented reality (AR) technology has been in existence for many years, but is only beginning to enter the mainstream in higher education. It was identified by the 2010 Australia–New Zealand edition of the Horizon Report published by the New Media Consortium (NMC) as having likely time-to-adoption of two to three years (Johnson, Smith, Levine & Haywood, 2010), and by the NMC's 2011 *Technology Outlook for New Zealand Tertiary Education* as having a time-to-adoption of four to five years (Johnson, Adams & Cummins, 2011). AR is a "live, direct or indirect, view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data" (Wikipedia, 2013). AR offers great promise for a greater blending of the real and virtual that will produce new educational opportunities. This is likely to include a social and multi-user augmented reality as has been seen with the development of 2D mobile social media tools. Examples of AR applications in health sciences and veterinary science education include imposing the internal anatomy of a body over that of a live video view of a real body for a simulated look inside the body or for virtual surgery practice. Students in history or archaeology could view landscapes or cityscapes to see views of how the location appeared in the past using mobile devices or HUD devices such as Google Glass, while students in architecture could view how a building design would sit in the landscape. Industrial and product design students could use AR models to assimilate their designed artefacts in 3D allowing for rapid changes such as shape, colour and texture to be done in real time. Today simple interactive AR models can be manipulated. This is done by using AR markers that are printed on paper that can be viewed through AR viewer applications showing a video feed of the scene with the 3D model superimposed in context. The user can move, rotate or block portions of the marker to produce changes in the model, for example, rotate a 3D exploded view of components of a car or tap on a virtual drum kit to produce musical tunes. Other examples include 3D car racing games that can race different users, spacecraft that can be created and moved or 3D models of shoes where users can change their attributes. Since AR can also be triggered by GPS and locative data, it can be used to reveal relationships between physical locations and other relevant information, e.g., as a navigation aid or associating indigenous knowledge with artworks on display.

Head-mounted displays

By using a head-mounted display, users will be able to fully immerse themselves in the VWs, providing the sensory illusion of actually being there. Preliminary research shows that users of devices such as the Oculus Rift have a higher perception of immersion and develop a near "haptic" feeling of virtual objects (Reiners, Wood & Gregory, under review). While such displays have been in existence for many years, their decreasing cost, size and weight in recent years have allowed them to enter the commercial mainstream. 3D stereoscopic glasses targeted at home users are now widely available for gaming and 3D video viewing purposes.

Gesture-based and other natural user interfaces

Through advances in, and mainstreaming of, 3D motion sensing technologies, gesture-based movement will become readily available so that what one is doing in the real world is enacted and represented through the avatar in the VW. Those in the VW will be able to see body language displayed through the avatars. The NMC, in its 2010 Horizon Report for Australia and New Zealand, predicted that gesture-based computing would enter the higher educational mainstream within four to five years (Johnson et al., 2010), and affirmed this prediction in the 2011 *Technology Outlook* for New Zealand (Johnson et al., 2011). The 2012 *Technology Outlook* for Australia again echoed this, though using the broader term "natural user interfaces" (Johnson et al., 2012). Empowered by such innovations, educators will be better placed to design interactive tactile learning tasks in a VW to engage students and encourage the achievement of superior educational outcomes. Haptic gloves are an example that have been around for many years allowing tactile and gesture based movements. Such devices, along with movement based sensors such as Kinect and Razer Hydra, will continue to find uses enabling VW participation to become all the more real, with many senses being used (Yeom, 2011).

Embodiment

Avatars will increasingly be capable of looking like their user and consequently immersion by students learning in a VW will become more intense. More realistic body language and animations for avatars will become mainstream. There will be easier and more intuitive ways to "trigger" avatar actions but live streaming movement is still some distance away from coming to fruition. Low-cost equipment like the Kinect and software packages like iClone can produce more lifelike body language and gestures, which enriches the interactions between avatars and provide more realistic learning opportunities.

Holographs

VWs will eventually come off the computer screen and be projected holographically, providing even greater dimension to the learning experience. Cisco recently began marketing holographic telepresence videoconferencing systems (see VanDervoort, 2013) that have the potential to greatly improve the sense of co-presence experienced by geographically distributed users.

Wearable technology
The most recent NMC Technology Outlook for Australia and New Zealand identifies wearable technology as being within the four-to-five-year adoption horizon (Johnson et al., 2013). Such technology will give people the ability to wear devices on their bodies as accessories or as part of their clothing and be inworld whilst undertaking other activities. Devices like Google Glass will enable this to occur where someone can continue to undertake their work in the real world, but have virtual inworld activities that they are participating available through their glasses. Wearable computing will be enabled as the size of computing devices continues to shrink and their power increase, allowing individuals to take a VW with them on the go.

Learning design, pedagogy and assessment in virtual worlds

Given the increases in fidelity, interaction quality and availability, the range of potential educational uses for VWs will continue to expand. In the future, the level of understanding of what is best taught using VWs would need to be more clearly defined and research-based. This body of knowledge will have built up over time and will provide a far better understanding of pedagogy and of the best utilisation of VWs for a given teaching and learning outcome.

Authentic learning
There will be an increase in pressure to ensure that research, learning and teaching will be authentic. Tasks should offer opportunities to examine problems from different perspectives, require collaboration, reflection and seamless integration with assessment (Herrington, Reeves & Oliver, 2010). Authentic tasks should have real world relevance and match it as nearly as possible. VWs are especially suitable for engaging in situated role plays (Carroll, Anderson & Cameron, 2006; Flintoff, 2009) to facilitate authentic activities. Authenticity will be bought about with more realistic storylines and assessment based on the story context and decision points. Authentic learning scenarios undertaken in VWs will provide opportunities for the learner to understand concepts and practise learning that may be impossible to do in real life.

Combining individual, asynchronous and synchronous collaborative learning
A dichotomy has emerged in that both multi-user or live synchronous activity in a VW and closed VWs where students can self-explore scenarios as many times as they like is occurring. Self-paced activities could involve the use of bots (non-player characters), machinima, or SoaS. Indeed it could be argued that taking a flexible, non-time dependent resource like a VW and constraining it is to retard its potential. However, if we were to consider the higher-order thinking processes involved when a student is given the opportunity to evaluate the inworld design of a peer, or engage in a complex multifaceted problem scenario, then the asynchronous task would have educational merit. VWs will be increasingly used for student self-practice sessions in this manner. These branches have the potential to be mutually complementary. Examples could be:

- Students performing certain activities in standalone versions of various VWs (e.g. SoaS);
- Preparing items or projects to be displayed in a location in a multi-user VW environment such as SL or OpenSim for other people to see and evaluate;
- Practicing a range of skills before launching into the bigger more chaotic multi-user environment;
- Making parts of machinima in the standalone environment for incorporation into a larger machinima that may be finished off or shown in a multi-user environment;
- Preparing individual assignments for submission to the teacher or peers for marking.

Action-based learning assessment
Learning in VWs established its importance and its place in VW studies during the last decade and consequently assessment played an important role in the process. Different projects were developed to assess students' learning in VWs. VirtualPREX (Gregory et al., 2011) is a 3D immersive virtual professional experience environment, using formative assessment to provide pre-service teachers with teaching experiences. Stealth assessment, as defined by Shute et al (2009, p. 299), is "embedded assessments … so seamlessly woven into the fabric of the learning environment that they are virtually invisible" and "can be accomplished via automated scoring and machine-based reasoning techniques to infer things that would be too hard for humans (e.g. Estimating the value of evidence-based competencies across a network of skills)". Al-Samadi et al. (2012) proposed a framework to design assessment and feedback for serious games using stealth assessment. VWs provide users with a chance of experiencing real-life situations to learn by acting in these environments. Action-based learning assessment method (ALAM) (Fardinpour & Reiners, under review) enables virtual training

environments to recognise avatars' actions, which are the reflection of human-user actions, classify these actions, and eventually analyse and evaluate them. ALAM uses an open taxonomy to be applicable in every 3D virtual environment and action recognition system. Currently, action-based learning assessment is used in virtual training environments as a specialised form of VWs, but this assessment method, or its components, can be extended and adapted into different virtual environments such as games, VWs, virtual learning environments, and virtual training systems. Immersive technologies have dramatically developed in recent decades. From the first uses of virtual reality in early sixties (Pimentel & Teixeira, 1993) to today's advance immersive technologies, the main idea was to immerse users into a VW and provide them a life-like experience in learning, entertainment, business, etc. Modelling, together with analysing human behaviour, performance and skills via VWs, needs the identification and evaluation of conducted actions. This is the significant contribution of ALAM as well as the taxonomy of actions in virtual training environments, to the future advancements in VWs.

Anonymity
The ability to have an anonymous avatar will continue to be the choice of the user. Many educators insist on their students having avatars that are not known to others for authentic role-play activities, such as playing the role of a primary school student in a teaching practice scenario (Gregory, 2011); or so that the student can state how they feel without the knowledge that others know who they are. This is sometimes important for the more shy students who will often, in a live classroom situation, avoid participating in classroom discussions due to various reasons, including the perceived risk of – ridicule, lack of confidence or not wanting to stand out. Anonymity can assist in avoiding these feelings.

Simulations and scenarios where immersion elements are important
VWs will be able to provide simulations in difficult situations students may possibly face in their careers. This will include complex interpersonal scenarios that will equip graduates of the helping professions with interpersonal skills developed at a higher level for increasingly complex working environments.

Game-based learning and gamification
The next few years will see greater convergence between VWs and games, with more widespread acceptance of gamification in teaching and learning. Game-based learning appears under the "two to three years" time-to-adoption section in two NMC reports (Johnson et al., 2011, 2012). It seems likely that immersive game environments will be leveraged towards learning activities – the shifts in the Minecraft community already reflect this (Reiners et al., 2012). VWs such as Minecraft can be used in all levels of schools and there will be a shift towards these types of worlds. A simple interface with minimal user investment will continue to greatly facilitate the ad hoc user, especially where inworld person-to-person interaction is the intention and the virtual space need not be very complex. A whole range of VWs will become ubiquitous such as the Internet is now. Game like VWs have become accepted.

Scalability and interoperability of virtual worlds

Currently the majority of content that is created in a particular VW is locked into that space. In line with the open access movement in other areas of scholarship and education in the future, strategies will be developed and technologies increasingly chosen for their ability to share content across the education community. There will be easier movement of avatars, builds and artefacts between VWs that will encourage economies of scale in the education resource development space. Work with open standards and build techniques with such tools as OpenSim, SoaS and meshes will allow us to more towards achieving that goal.

Open access/integration
Trends towards open access and open standards in education communities will lead to there being "Open Access" virtual repositories where designs for virtual spaces, re-usable components for building virtual spaces, software tools, pedagogical designs, lesson plans and the like can be shared, taken, tested and improved upon (Boyd & Ellis, 2013). Similar such repositories for 3D CAD files are already being used by the additive manufacturing movement sharing or commercialising their designs for 3D environments or 3D printers. Lack of standardisation of formats is limiting the direct transfer at the moment; yet merging is anticipated for future applications. Verification of 3D objects in VWs before printing, enhancing documents with 3D designs, or having 3D objects as gifts in social games are just a few examples benefiting from a common standard for encoding 3D models. Ideally there should be no limitation on inworld tools. VWs should move for greater integration to third party applications such as OpenOffice or Skype, social networking tools and Smart Boards. The move towards the use of open technology standards could assist this process but it remains to be seen in light of proprietary vendor interests. It may take open source alternatives to spur this on just as OpenSim has proved an alternative pathway to sharing WV objects and builds.

Scalability
There will be greater ability to tailor the size and constraints of the virtual space to suit the learning task. When a great number of users interacting at the same time or a free roam approach is favoured, then the current offering of "worlds" suit well. When tasks like role-play are the goal, perhaps smaller discrete virtual spaces are better suited. Being able to offer bespoke discrete virtual spaces is currently available via SoaS and Jibe, but we should see more design and intent built with this in mind.

Machinima
Machinima will continue to have a place in VW teaching. The use of machinima enables students to learn through VW technology without students having to log into the VW and participate in activities. A good example of this is the work done in Queensland University of Technology in Law (Butler, 2012), Central Queensland University in Accounting (Muldoon, Jones, Kofoed & Beer, 2008), University of New England in Pharmacy (Gregory et al, 2012) and the University of Western Australia which hosts the largest machinima competitions in SL (Highley & Jegathesan, 2013). Machinima is affordable when the $1800 annual cost of a SL island (taking into consideration of the 50% educational discount) is apportioned across students over several years – and is more affordable than real life video for producing simulations (or even less if VWs like OpenSim are used). Individual academics can use machinima as a cost effective, broad canvas for the creation of simulations and authentic learning environments. This compares favourably with real life video which requires substantial funding and be limited in terms of the locations that are practically available (Butler, 2012). Machinima is a cost effective means to contextualising abstract principles, to depict scenarios that resemble situations that students may encounter in real world practice and provides a context for future students who may use a VW as a teaching resource.

Conclusion

The present sees VWs at somewhat of a crossroads facing a number of obstacles such as the lack of familiarity of academics with VWs technology, lack of awareness of its affordances, general IT literacy of the academic and student populace, professional development/training availability, institutional infrastructure blockages, ease of use (or not) of the tools available to build VW spaces (especially by the average academic), little institutional intent or guidelines for curation of VW assets, bandwidth availability for those not on broadband or multiple users in one area, along with the inherent technological/physics limits to mobile/wireless bandwidth. Given these factors, it is likely that over the medium term, the proponents of VWs in education need to be concentrating on having VWs work on current and near term hardware (PCs, iOS/Android tablets) that are in student homes and academic environments now. However, research and knowledge will forge on. Specialist applications will see cutting edge input and visualisation technologies move forward and while these may well be hampered in the medium term by more mundane factors such as "fashion" (as it has done for countless clever devices in the past) for use outside of a lab, eventually these will reach the stage of a light weight Google Glass style interface at which point they will make their public debut. Over time, VWs will become increasingly accepted by institutions as part of the educational landscape and improvements in the usability, compatibility and mobility of VW technologies will allow increasing numbers of academics take advantages of what VWs have to offer. The advances expected in the fidelity of the technology, the ability for multiplicity of expected access opportunities via the use of natural interaction and mobility coupled with an increase in pedagogical knowledge will ensure a strong future for VWs in the teaching and learning arena.

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Transmedia in English Literature Classes: A Literature Review and Project Proposal

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This paper is the beginning of a research project which will explore the function and impact of Transmedia (TM) in Higher Education (specifically English Literature studies). There are several underlying assumptions that are being tested about the range of benefits to students of using this technology. These include: that TM deepens student understanding of the nature of creative expression (including literature); that TM deepens student engagement with the traditional literature they have been studying; that TM releases students' creative expression; that TM provides students with insights into the extraordinary creative power of digital technologies; that TM deepens students' sense of community (both within and beyond class).

Keywords: Transmedia, Blog, Vlog, Facebook, Pinterest, Engagement, English Literature

Background to this investigation

With a background of using Blogs and ePortfolios to create individual digital literature journals with peer interaction (using WordPress.com), ACU literature students have now been prompted to begin using Transmedia (as either Vlogs, Special FaceBook accounts, Pinterest, Cartoon Creation and other Web 2.0 tools) in two units during first semester 2013: Shakespeare and the Renaissance & Nineteenth Century Literature.

Sample topics used in two Literature Units: ***Shakespeare and the Renaissance & Nineteenth Century Literature***

Sample transmedia tasks that have already been used in classes are provided below.

> **Shakespeare (3rd year unit):** Write/Film a modernised "Transmedia" story in which Hal and Falstaff confront each other in Love and Hate. Within your group allocate roles and responsibilities. Along with these roles two people could work together as "Directors", two people could work together as technology scouts (i.e. researching what transmedia elements could be used in this joint presentation). Use each of your WordPress sites to set up components of the story with clear links from one site to the other. Two people could be set up as "Critics" and "Troubleshooters": your job to inspect how the story is going, how it is working.
>
> **Nineteenth Century (2nd year unit):** Write/Film a modernised "Transmedia" story in which Charles Dickens, George Eliot (Mary Anne Evans), William and Dorothy Wordsworth meet at a dinner party to confront the question: "How can we help to make the lives of the generation who are now between 17 and 25 more rich and meaningful?" Use each of your WordPress sites to set up components of the story

with clear links from one site to the other. Two people could be set up as “Critics” and “Troubleshooters”: your job to inspect how the story is going, how it is working.

This concise paper will present a Literature Review of Transmedia and will also outline a research study going forward.

Transmedia Literature Review

Transmedia is "a single experience that spans across multiple media" (Warren, Wakefield & Mills, 2013, p. 67). Lamb (2011) elaborates, defining transmedia storytelling as follows:

> "Transmedia storytelling involves a multimodal, multimedia story with nonlinear, participatory elements. Resources connected to the story might include print materials; documents; maps; web-based clues; mobile apps; cell phone calls; social media connections; activities and games; and media such as audio, video, or animation. The main storyline may or may not reside in one location, such as a traditional book or website." (p. 15)

The variety of media components utilised in transmedia approaches can be used to provide additional information, amplify the importance of minor characters in the main narrative, or even add new characters that were not a part of the original story (Pence, 2012). Transmedia environments also ask readers to seek out content, explore information in different contexts, evaluate ideas across formats, and interact with other readers (Lamb, 2011). They are are non-linear, deeply immersive, intersubjective, and require student evaluation of content (Warren, Wakefield & Mills, 2013). Many of these elements have emerged from our experience with recent student output.

Transmedia learning environments can enhance the learning process not only by creating an immersive and engaging learning environment, but also by building on the digital literacies of younger generations of students, providing a context for collaborative problem solving, and integrating seamlessly with emerging cloud computing resources (Pence, 2012). Transmedia approaches encourage student centred learning by actively challenging teachers to have students put what they see, hear, and read to use (Jenkins, 2010). Learners can control the exploration process and how they engage with the artefacts, and can also interactively evaluate ideas with other learners (Warren, Wakefield & Mills, 2013). Transmedia learning environments have been used in university contexts to encourage inquiry, critical thinking, problem solving, creativity, reflection, and critical discourses (Warren, Wakefield & Mills, 2013, p. 67). Again our current cohort of TM students reflect many of the elements described in this literature review.

Transmedia narratives have stemmed from the marketing field, where multiple modes of communication are used for promotional and engagement purposes. Askwith (2009) offers four principles to guide the use of transmedia, which resonate with learning and teaching:

1. Focus on creating a consistent and unified experience across all platforms
2. Let each platform do what it does best
3. Ensure each element works on its own terms but also adds something to the broader experience
4. Bring people together and give them something to do.

Fleming (2011) goes further to propose that for transmedia education projects it is important to:

- consider which media platforms best suit the needs of learners
- wherever possible extend the learning beyond the classroom into the broader community
- engage learners so that they are deeply immersed in the narrative
- if possible embed the learning in real-life settings.

Pence (2012) talks about two different poles of transmedia usage:

- Experience (or closed) transmedia: Various media platforms are used to create a unified experience for others.
- Framework (or open) transmedia: An existing set of resources is adapted by users to evolve a new vision of that world, where no single author (or group) has control.

These principals and observations have provided key ingredients to the strategies being employed in this Higher Education research project. Learning experiences have been constructed with many of these elements in mind, but there is an underlying key question that needs to be addressed when designing learning experiences: teachers need to consider the extent to which they design transmedia learning experiences as a stepwise narrative or allow them to be more 'rhizomatic', encouraging students to branch out following their own creative inclinations.

Transmedia approaches have already been used in several educational contexts. The inanimate Alice project (http://www.inanimatealice.com/about.html) introduced teachers and students to new media literacies (Pullinger & Joseph, 2011). Using a more closed transmedia approach Facebook was used to construct an adaption of Shakespeare's *Much Ado About Nothing* (http://mashable.com/2011/04/25/shakespeare-facebook-cyber-bullying/ Ophelia Project, 2011) and *The Tempest* and Kafka's *The Trial* *(http://thecreatorsproject.vice.com/blog/transmedia-theater-projects-tell-the-stories-of-shakespeares-itempesti-and-kafkas-ithe-triali).*

Jenkins (2009) proposes that transmedia approaches also develop and (test) students 21st Century literacies including the abilities to:

- search for, remix, and distribute information across various media platforms
- manage, analyse, and synthesise multiple streams of information
- develop independent creations that are integrated as a whole, and
- represent multimodally (for instance through through images, text, audio and video).

Transmedia participants need to be accustomed with interactivity, networks, screen fragmentation, rapid presentation, rapid adaptation, intertextuality (where texts affect one another), and working across multiple screens (Scolari, cited in Pence, 2012). Teachers can support student performance on transmedia task by guiding media selection and other related transmedia processes (Jenkins, 2010). Much of this is borne out in our current work with ACU literature students.

In their Learning and Teaching as Communicative Actions (LTCA) framework Warren, Wakefield and Mills argue that Knowledge Construction occurs through an iterative process of ardent inquiry and communication actions (normative, strategic, constantive and dramaturgical) that lead to critical thinking. This can be used to guide transmedia learning design. It is principles such as these that underpin the kinds of exercise that we plan to use with students over the coming year.

THE IMPENDING STUDY

Based upon initial observations this year of new forms of learning resulting from transmedia approaches, a formal investigation of cause and effect mechanisms will commence next year. As well as examining the nature of these emergent epistemologies, the project team will analyse how the task design and pedagogical strategies influence learning. This will involve triangulating student work samples with student feedback data (surveys and interviews) and teacher observations to determine cause and effect mechanisms that enhance the learning process. We invite feedback and participation in the refinement of instruments and analytic techniques.

CONCLUSION

The purpose of this short paper is to project into the future and explore the way that Transmedia could significantly alter the landscape of teaching in the humanities (with clear application to other areas). In line with Pence's observation our research is underpinned by the question: "If teachers fail to introduce some freedom to exercise creativity into courses, will conventional course presentations methods hold the attention of young people who have grown up with the Internet, transmedia, and alternate reality games?" (Pence, p.136). This approach is further born out in the following observation:

> "Aaron Smith points out that one of the major challenges facing television and motion picture producers is finding a way to cater to casual viewers while also providing an immersive environment for those who wish a full transmedia experience [5]. Will educators face a similar situation, trying to satisfy students who wish to become more involved in creating the course material while still serving those who wish to exert as little personal effort as possible?" (Pence p. 138-139)

Aaron Smith's comments are central to one of the key issues confronting educators and that is whether the expressive freedom provided to today's students is sufficient to animate their creative interests. So it is an ongoing challenge to ensure that the new technologies are presented in such a way that they do become serious tools of learning while at the same time stimulating and sustaining a real interest in the academic area(s) they are operating within. As Lamb has argued:

> "Today, young people may choose from many different devices that serve a variety of functions. But does technology-based reading enhance or distract from the learning experience? The answer may depend on whether the media elements and technology tools are integral or incidental to the reading experience." (Lamb, p. 17)

So while we might be very excited by the new worlds of learning possibilities being opened by Transmedia tools, we need also, very much, to be clearly attuned to how these tools might best operate – to deepen learning, engagement, and enjoyment, within the framework of the units we currently teach. This is our challenge over the next 12 months.

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Developing social media training resources for AusAID scholarship students

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Potentially, effective social media use has a valuable role to play in addressing a number of concerns for newly arrived international students including feelings of isolation, access to information and participation in community. The aim of this paper is to report on a project to develop social media training resources for AusAID students from developing countries. The project was delivered as part of a six-week, 100-hour introductory academic preparation program. Using an action research approach, we conducted three stages of materials production, data gathering and self-reflection. In our overall analysis of the project, we identified resistance to participation, information overload and technological impediments as central barriers to full integration of social media training. We conclude with suggestions for improvement and research in the development and integration of social media training resources.

Keywords: social media, training, international students

Introduction

As part of its commitment to international development, Australia welcomes thousands of graduate students from developing countries who have been awarded Australian Agency for International Development (AusAID) scholarships. Soon after arrival, many AusAID students struggle with adjustment issues that include finding appropriate accommodation, dealing with homesickness and culture shock, and coming to terms with Australian academic expectations (Stone & Gruba, 2012). To assist newly arrived AusAID students, Australian universities provide a 4-6 week Introductory Academic Program (IAP) to help students to cope with adjustment.

The effective use of networked technologies is crucial to both the social and educational lives of university students (Mcmillan, 2006). Indeed, throughout a range of Australian tertiary institutions, there is a strong and active promotion of social media use; at the University of Melbourne, for example, students are encouraged to connect as they apply for entry, to share photos of campus visits, and to stay in touch as alumni long after graduation. In a June 2013 count, for example, the University Library had approximately 5,800 followers on Facebook; for the central University account, there were just over 23,000 Twitter followers. The university has established social media use policies and usage guidelines [socialmedia.unimelb.edu.au], and like many universities, staff are urged to understand the potential risks associated with the institutional uses of social media (Woodley & Beattie, 2012). What we couldn't find, however, were resources for student training in social media use. In light of such a strong promotion of social media use, we began to wonder: Where do students from developing countries learn to use social media? Could social media training assist AusAID students? What resources were available for the teaching of social media use?

In this paper, we report on our efforts to develop and use social media resources for newly arrived AusAID scholarship students. Funded by a university teaching grant, we undertook an eighteen-month action research study to develop, use and integrate social media into an academic orientation program for AusAID students. Following a brief review of the literature, we describe our efforts, report on key outcomes and suggest areas for further research and development.

Social media training and use

One way to view efforts to train students in the use of social media is against a larger backdrop of 'new literacies' education (Gammon & White, 2011; Lankshear & Knobel, 2011). New literacies educators seek to transform the role of technologies such that their use creates a culture of participation such that learners feel engaged as they create, share, and review ideas (Jenkins, Purushotma, Weigel, Clinton, & Robison, 2009). For Gee (2004), it is important that participatory online cultures foster 'affinity spaces' that make learners feel comfortable and supported. If used effectively, social media can help to facilitate a sense of 'connectedness' amongst learners (Greenhow & Robelia, 2009; Rosenthal, Russell, & Thomson, 2006), and thus reduce feelings of isolation and loneliness that international students may experience in Australia (Arkoudis et al. 2010; Sawir, Marginson, Deumert, Nyland, & Ramia, 2007).

Other researchers, such as Wise, Skues and Williams (2011), argue that the use of social media may have a limited role in promoting student engagement. Indeed, they point out, the multi-faced concept of 'student engagement' is challenging to define as it touches on the complex relationship amongst the institution, learning and student interests both socially and academically. Reporting on a study of nearly 700 first year students using a range of measures, the researchers found that "the value of social media tools in an academic environment may be solely psychological, e.g., promoting positive affect, and norming experiences" (Wise et al., 2011, p. 1340). Importantly, they conclude that if a social media is used, the promotion of a microblogging service (Twitter) may have a greater impact on successful learning than a social network site (Facebook).

In their examination of social media use amongst academics, Adi and Scotte (2013) divide barriers to implementation into those that are first-order, or extrinsic to instructors, and those that are second-order, or intrinsic, to instructors. First-order barriers, they argue, and can be tackled through provision additional institutional resources, professional development and staff support. Confronting second order barriers is much more challenging, Adi and Scotte (2013) argue, in that academics must shift their thinking in regards to knowledge integration, their purpose of social media use, and as part of their overall attitude. For Lemon (2013), intrinsic barriers to social media integration for academics most often revolve around concerns for privacy, time commitments, information overload, and learning to work with large communities of learners.

Moving away from institutional and academic concerns, we turned our attention to student motivation: Why should AusAID students hone their social media skills? It is clear that a lack of ICT resources in developing countries has retarded new literacies proficiency rates (Doong & Ho, 2012), but the rapid uptake of mobile technologies across the globe may act as a catalyst for improved conditions (World Bank, 2012). Greater social media use may help to bridge the digital divide (Ali, 2011). Greater social media use may also spur innovation in developing countries. Using Tanzania as a case study, Munguatosha, Muyinda, and Lebega (2011) report on the construction of a model for social networked learning in higher education that is appropriate and sensitive to local factors (Srinivasan, 2012). One key component of their model is to promote the idea of learning communities and student-centred pedagogies through low cost mobile technologies as a way to encourage adoption of social media. In their study of medical professionals in developing countries, Pimmer, Linxen and Gröhbiel (2012) note the importance of participation in virtual communities to bolster educational opportunities, occupational status and professional identities. Accordingly, they argue, the proficient use of social media in 'limited technology' contexts is key to ongoing professional development.

In summary, our review of literature suggests that social media use may help students to better engage with universities, but such a positive view is tempered by what it may mean 'to engage' students or how to overcome barriers to social media use amongst academics. In developing countries, social media is being used to lower the digital divide and promote innovation. Students from emerging countries in Australia may benefit from social media training as a way to hone digital literacy skills, and thus benefit during their studies as well as when they apply their skills to development projects and as a way to build their own professional identities.

Project context and approach

The University of Melbourne is one of several Australian universities that deliver award programs to the federally funded AusAid Australia Awards scholarship initiative. Across Australia, $331 million in scholarship funding was made available in 2012/2013; graduate students taking part in the initiative come from Asia (61%), the Pacific region (18%), as well as Sub-Sahara Africa (15%). One of the major goals of the scholarship program, for both Australians and others, is to foster links amongst peoples, nations and global projects (AusAID, 2013).

As part of their obligation in accepting AusAID scholarship students, Australian universities are required to offer an Introductory Academic Program (IAP). Briefly, the purpose of these pre-sessional programs is to assist newly arrived AusAID students to cope with the demands of Australian graduate study, particularly in regards to the development of critical thinking and academic writing skills. Such programs provide assistance with budgeting, accommodation and strategies for acculturation and personal safety. At the University of Melbourne, the IAP hosts approximately 300 students per year consisting of 25-40 nationalities across 27 discipline areas.

Motivated to improve pedagogy, we thought it appropriate to adopt an action research approach to our study. Enquiries grounded in action research are characterized as instructor-led, flexible, aware and situated in a local context (Costello, 2003; Somekh, 2007). Within a longitudinal action research project, four cycles are typically enacted at each stage: Plan, Act, Observe, Reflect. Over the course of 18 months with three different student cohorts (Summer 2012, Winter 2012, and then Summer 2013), we worked with a total of 16 tutors and approximately 480 AusAID scholarship students as we sought to integrate social media use in the IAP. At the end of each cycle in a stage, we noted our efforts and challenges, and continued to develop our efforts (Table 1).

Table 1: Action Research outcomes by stage and cycle

Stage number and intent	Plan	Act	Observe	Reflect
1) Establish the project; gain experience in using and teaching social media	Based on literature and previous experiences, developed an approach to social media training	Created a paper-based guidebook for social media training; some professional development and integration	Easy to distribute, but students set it aside in lieu of other concerns; difficult to update	Paper-based materials too inflexible – must move online with a strong push for initial integration
2) Gain further experience; strengthen professional development	Deconstructed previous materials to prepare move to online presentation	Created a website with a range of distinct stages and resources; some professional development and promotion of use	Delayed introduction of the training resources diminished uptake amongst students, reduced staff enthusiasm	Need to reposition the social media training within the program, and emphasize and expect its use from the start
3) Full integration of the materials	Based on feedback, revised site with updated resources	Strong emphasis on professional development and program integration	Positive reaction to strong introduction from the start of the program; integrated	Time to move the site, and training, to the entire University community

In the following sections, we reflect on these stages before discussing the project as a whole.

Stage 1: Gaining experience and understanding

Admittedly, our efforts in the first stage in the summer of 2012 were modest as our aim was to gain experience and understanding of social media resources. We developed a small paper-based booklet and placed it within our set of academic materials. After a brief general introduction to students, a graduate student from a developing country was hired to help promote social media use. The graduate student, we thought, could act as a role model as she tweeted on a daily basis, posted photos and visited workshops to provide tips for effective use.

From student surveys and interviews, we discovered that the general view of social media was to connect with colleagues, friends and family. The students, not surprisingly, also saw social media as a way to get information and opinions and many already made extensive use of a range of tools. A concern for privacy was a common, as students worried that social media facilitated unwanted attention, misrepresented individuals, or perhaps evoked persecution by authorities. On a more personal scale, they were concerned with time wastage, ‘addictions’ or information overload, as well as maintaining personal boundaries. Students pointed out that excessive social media use could cause a lack of connection to people in the ‘real world’. Finally, technical and financial concerns of the cost of Internet use in some countries were given as a reason for the high use of mobile phones for communication and networking (not, for example, through computers per se).

Given the high familiarity and use of social media, we thought our project to be unnecessary. Students from developing countries knew how to make use of social media: end of story. Our materials had readily been set aside during the IAP. Our Twitter site remained quiet. In the following months, as we continued to monitor AusAID students use of social media, we found that they had no greater engagement in the university than those in previous years. Students again reported poor computer literacy skills as a key barrier in their studies. Perhaps not surprisingly, student suggestions at this point centred on how to join Facebook. One AusAID student simply reminded us that “lessons on social media must be done in the computer lab or room with computers without which it seems much like ‘learning to swim by reading a book’.”

Stage 2: Developing social media training resources

Now at the second stage of our project, we converted our paper-based materials into an online site [as a ‘sandbox’, we used an off-campus commercial provider for ease of editing]. We started with the basics of accessing on-campus facilities, and then moved onto essentials, related social media sites, pedagogical activities and social resource sites (Fig. 1)

Figure 1: The resource site for social media training

From earlier experiences, we understood that technical issues for students needed to be solved before moving onto further discussions of social media use. Throughout the site, we created visual step-by-step guides with annotated screenshots to help students in navigating complex web and application settings. As a way to promote use, we hired a specialist tutor to run workshops throughout the six-week IAP. Tutors were given some training.

We launched the social media resource site [gosocialmelb.com] in the second full week of the Winter 2012 IAP. Unfortunately, a delay in the launch gave the impression to both students and casual tutors that our work was an afterthought. Indeed, although we used Twitter on a daily basis and made staff available for individual social media training, there was little uptake of the materials. To wit, we had not integrated them well into our syllabus and they were generally set aside in lieu of other seemingly more pressing concerns. Two points clearly emerged at this stage: a) flexible resources, even those that are well-considered, must be promoted to become truly effective, and b) students must be motivated from the start to use social media if they are to see its use relevant to their studies and professional development.

Stage 3: Integration, and motivation, from the start

By the third stage of the project, the IAP program itself came under the leadership of a new program coordinator. The new coordinator revised sections of the curriculum, placed greater emphasis on initial tutor training, and employed a casual tutor specifically to handle aspects of social media integration and use. Accordingly, social media training was moved to the first week of the program in two 2-hour workshops: a)

‘Introduction to University computing resources’ (email, LMS, student portal, etc.) and b) a two-hour information sessions concerning social networking, purchasing advice, and connectivity. Following that, we offered three hour-long drop-in sessions for individual consultation. Notably, we emphasized the professional networking site, *LinkedIn*, to the students as we invited students to imagine themselves after graduation working as a global professional. In workshops, we demonstrated how other professionals were using the site to spread and enhance their reputation. We also demonstrated live tweets from events as they were happening (#spill was popular with students as they followed changes in Australian politics, for example) as a way to make social media use come alive. Discovering hashtags related to their own interests we hoped would spark motivation.

To evaluate our efforts, we invited students to participate in an online survey. Just 53 of the 160 students (30%) responded in. Overall, results pointed to a lack of familiarity or information, a feeling of being busy, or simply a disinterest in resources, particularly in Twitter. Despite our best efforts, the survey revealed that most students were not even aware of our own social media training resource (Fig. 2).

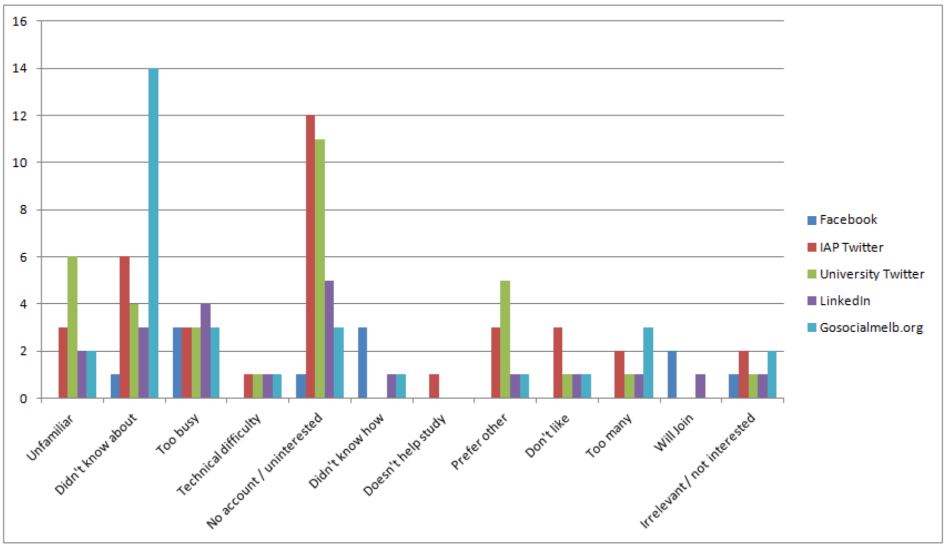

Figure 2: Survey results of social media use

Further analysis revealed that AusAID students made relatively little use of social media. Of the 53 respondents, 12 of the students, or nearly 25%, reported that they had not joined the Facebook Group; 41 out of 53, or about 80%, had not followed our IAP Twitter account. Other survey data, gathered two weeks after the end of the IAP, showed that overall use of social media had in fact *declined* amongst the AusAID students (Figure 3).

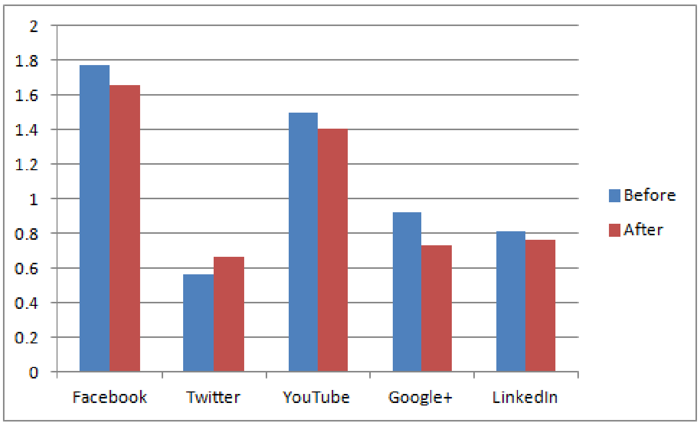

Figure 3: Survey results of social media use

The lone exception to the overall decline in social media use amongst AusAID student was that of a slight increase in the use of Twitter following the conclusion of the program. What had gone wrong with our project? Our primary goal to stimulate social media use was certainly not an outcome in our work.

Discussion: Learning from our past

The purpose of our project was to develop and use social media resources for newly arrived AusAID scholarship students. During 18 months of working periodically in three stages, we first developed paper-based materials, then online materials until developing a full resource site. The use of our materials was mixed throughout, with casual tutorial staff wary to use social media and students seemingly too busy or simply uninterested to make use of the materials. At this point, we took stock of the key challenges (Table 2).

Table 2: Summary of overall project challenges

Themes	Description
Wariness to participate	As a whole, casual tutors and related academic staff showed reluctance to participate fully in social media use, and thus did not foster student participation in the project.
Professional development	Time for professional development for casual tutors, limited to a short time, was focused more on larger issues of AusAID student adjustment than social media use.
Curriculum integration	Situating social media training is difficult in a program that stresses the need for Australian culture familiarization, academic writing, and critical thinking.
Information overload / time pressure	Students often felt overwhelmed with pressing cultural and academic adjustment processes to the detriment of social media training or awareness.
Technical proficiency development	Our goal, to encourage social media use, often became confounded amidst the challenges of providing sufficient resources to develop fundamental technical skills.

Echoing concerns raised by legal experts (Woodley & Beattie, 2012), a number of staff on the IAP were wary of potential risks of social media use. In a sense, such hesitancy touches on the second order barriers that may hinder technological and media integration (Adi & Scotte, 2013) that includes poor personal experiences with social media or negative views gleaned from mainstream media (Arceneaux & Schmitz Weiss, 2010). Working with a large team of casual staff, our options to influence professional attitude, or to create a vision that motivated purposeful use, were limited because we had little time to train them at the start of the program.

The IAP is held twice a year, with a changing group of casual tutors and academic staff, and thus professional development opportunities are limited. Although the sustainable program set out by Signh, Schrape, and Kelly (2012) is clearly desirable, casual tutor training would be difficult to align with university strategic goals, be integrated into a reward system, able to afford ongoing opportunities and be made to be fully accountable amongst participants. Tutors, already wary of social media, thought that its use lay outside their contractual obligations; in short, our attempts at professional development amongst casual tutors were poorly received.

Because the IAP is designed as an intensive six-week program, the curriculum is packed. Over the years we have added and deleted, changed and then rejected several initiatives. How much should we continue to highlight social media training as a core skill amidst efforts to develop critical thinking, strengthen efficient reading, practice academic writing and encourage tutorial participation? In discussions, we have committed to the development of 'new media literacies' and perhaps we must face up to our own second order barriers of creating a purposeful vision (Adi & Scotte, 2013) in a world that is 'always on' (Baron, 2008) and in constant contact (Gillen & Merchant, 2013).

Time pressures during the IAP may have thwarted student uptake of social media use. In follow-up interviews, students told us that they had little time to use the site during the intensive program. Two weeks after they left the daily interactions of the IAP, students came to realize that tools and sites had social utility. Some now signed up for an established Facebook site. For students, the need to reconnect with their former IAP classmates was now a motivating force to make concerted use of social media. One student summed up the sentiment in a single post -- "Anyone miss IAP like I do?? hehe.. :)" – but in our subsequent periodic monitoring of the site, we found that any further uptake and use was limited beyond a self-select group of AusAID students.

In general, we underestimated the technical difficulties that students encountered. Holding hands-on activities and workshops, though a valuable and oft-repeated suggestion from students, is resource intensive. Logistically, we found that computer labs were difficult to book for extended periods. Further, because the focus of our workshops within the IAP program was on the use of official university websites and the LMS site, we sought to utilize university computers as much as possible rather than students' own devices. Students, however, often preferred to use their own devices. For us, though, given the peculiarities of a range of devices, operating systems and native language interfaces, we were soon overwhelmed trying to 'support' such a range of technologies and systems. student devices. Students, too, were keen to receive advice on 'the best' local Internet Service Providers, as well as 'the best' laptop or 'the best' smartphone; oftentimes, we shied away from giving such advice because we are university employees and not willing to provide commercial advice.

Critical self-reflection: Understanding our present

Ideally, our project would have fostered sustained and engaged AusAID student participation within local and institutional 'affinity spaces' (Gee, 2004) through the use of social media. In turn, training at the early stages of their academic careers would then lead students to increased understanding and use of sites across the vast global network of cyberspace. But the realities of time pressures, skill limitations, resistances to use and curricular demands tripped us up, and we now realize such a project must be long-term and developmental.

Our own analysis reminded us of two points; 1) being mindful of the capabilities of newly arrived students acclimatizing to a challenging environment, and 2) a keen awareness of curriculum and delivery issues within a multi-faceted, intensive program. Slowly, though, we came to understand that our project originally geared towards social media training came to be used for a range of differing purposes (Table 3).

Table 3: Varied goals of social media training for AusAID students

Purposes	Description
Technical training	Essential, hands-on education to direct students how to make use of University resources effectively and/or to connect mobile devices to local providers
Intergroup participation	Foster a sense of participation across the 200 member group that consists of 25-40 nationalities from diverse backgrounds and cultures
Information and media literacy	Provide an understanding that, increasingly, the 'news' comes in the form of online tweets and blogs often from private individuals with direct experience of the event
Alumni and professional networking	Encourage students to stay in touch with other University graduates and/or to build their own professional contacts through demonstrated knowledge and related personal connections

As our own thinking and experiences matured, we realized that 'technical training' was the least of our worries. Though from developing countries, AusAID students tend to be amongst their countries' most capable and many of the scholars had extensive international experiences. Program after program, we continue to be impressed that most students arrive with (or quickly purchase) the latest smartphone, a thorough knowledge of global network sites, and a keen understanding of creating and sharing media. There are some exceptions, of course, but no longer do we have to offer a remedial course in computer basics as we did just three years ago. Nonetheless, at this point, we continue to stress the need for technical proficiency in the IAP, especially in the areas of accessing library databases but now highlight efficiency of getting information more than simple basics. This seemingly contradictory approach – not to worry about technical training but continue to stress it in some ways – points to our need to balance the widely varying skills across the diverse cohort.

Each of the three cohorts we worked with during this project was relatively large. In the two summer sessions, the number of students ranged from 160 to 210; in the winter, the group consisted of 100 or so students. The group is diverse, too, with nearly 45 nationalities and approximately two dozen discipline areas. In the first stage of the project, we sought to use social media to encourage participation across the large group. We found, however, that the reality of seeing each other almost daily for six weeks largely undermines the need to 'connect' through online postings. The most popular use of our collective site was as a repository for shared online photos. Photography is a serious pursuit for a few students, and as such, they take on shared roles of 'unofficial photographers' throughout the IAP. In a similar manner, one person would read a tweet or see a Facebook update and simply tell others at shared morning teas, in classes, or at extended lunch times.

One reason we started this project was so that students could better respond to University resources. In particular, we monitored what the Library was tweeting but soon found that many postings were simply informational or meant to amuse. (Postings included, for example, 'We will be in holiday mode next week' and 'Ever wonder what WWII chemicals smelt like? Check out these cheerful posters …'.) For newly arrived students, the University postings captured neither their imaginations nor met their needs, and certainly did not evoke a sense of immediate urgency.

The delivery of social media training resources within an intensive course raises particular issues around what is compulsory, and hence assessable, and what is not. We took the entirely voluntary approach, hypothesizing that students would be self-motivated to connect and engage. However in an environment of 'information overload', the training resources that we provided were not best utilized. Students later said that they would have preferred dedicated instruction on social media technologies in a computer lab-like environment, just the same as they had been offered for the university's LMS system, citation management software and so on. This would require internalizing the social media resources fully within the program and training educators such as tutors to incorporate social media within the course. To do so would require a shift of mandate so that familiarity with social media is considered an essential academic skill. Conversely the training materials could place a greater emphasis on use of social media for academic ends, something we would argue is long overdue for all students, not just international students. For example, students could be asked to organize a group project via a social media event feature.

Training resources need to be highly visible and promoted. In our experience working with AusAID students for nearly a decade, the digital divide between AusAID students and local students appears to be narrowing. Perhaps *all* students could benefit from social media training at the start of their studies. In this respect an approach that's easy to access but expands to depth of issues which students have often, in our experience, not considered such as privacy, identity management, professional social networking and academic use of social networks. Designing training materials such that the reach across spectrum will likely make it easier to justify the inclusion of these resources to institutional stakeholders. While perhaps an obvious conclusion, our experience highlighted the fact that it is insufficient promote yet more online materials to those students already experiencing 'information overload'. Social media use is not, for most students, a high priority in light of the competing demands of tertiary study.

It became apparent to us during the project that we must target the effective use of student owned mobile devices. Earlier, though, we were overwhelmed with trying to provide 'support' for a wide range of technologies. Perhaps because handheld mobile devices are widely use in developing countries (World Bank, 2012), students prefer their own devices over university computers and laptops. It is a reality we need to direct more attention to meeting technical issues of local connectivity for AusAID students before we can move onto social media use. One novel solution would be to host a collaborative 'super-workshop' in a lecture theatre for a large number of students in a single day. Together, both local and international students could focus on getting connected and sharing tips for device settings. Ideally, such activities would provide the ideal opportunity to then organically introduce social networking activities to build on basic skills and continue engagement after a technical focused session.

Electric dreams: Imagining the future

Although we are alert to possible feelings of social isolation and loneliness for newly arrived students (Arkoudis, et al, 2010; Rosenthal, Russell, & Thomson, 2006; Sawir, et al, 2007), it is interesting to note that AusAID students did not raise the such issues until we interviewed them after the IAP had finished. One suggestion, from several students, was to provide resources that would assist students to connect to local ethnic communities. Nonetheless, such training might well be odds with university goals to increase student engagement: Indeed, we were keen to pursue the role of social media in enhancing 'connectedness' and 'affinity' with Australian culture. One area ripe for further research, then, is to investigate the actual use of social media through an analysis of affinity discourse (Gillen & Merchant, 2013; Zappavigna, 2011). Such work could shed light the relationship between student perceptions of institutional goals related to international student engagement.

In line with the work of Mirrihai, Dawson and Hoven (2012), it would be helpful to identify key actors amongst newly arrived students as a way to help motivate social media uptake. With a better understanding of key actors, we can imagine devoting our limited time and resources more to those students who were likely to train others. Over the long term, we would like explore how students socialize into discourse communities. Similar to the examinations of how computer-mediated communication influences pragmatics (Herring, Stein, & Virtanen, 2013; Lee, 2011), we would like to investigate how newly arrived students come to understand and use discourses specific to an Australian tertiary institution. To do this, we need to make use of closer observational techniques, for example to capture how students make sense of texts (Barton & Lee, 2013), look at their patterns of interaction within online connections that may foster a 'imagined audience' (Marwick & boyd, 2011) and undertake computer mediated discourse analysis of their work (Zappavigna, 2012). For us, it is important in future work to emphasize the role of language socialization as students take up social media tools and resources.

Finally, we would like to return to question that sparked our project: Where do students, particularly those from developing nations, acquire new literacies and learn to use social media? We can imagine a future when such skills training is essential to university students, and we wonder what the role of staff will be, and how policies will be shaped, and how issues regarding wariness, privacy and the lack of time will be addressed. Beyond action research, a longitudinal mixed methods approach across several institutes may provide answers.

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Reviewing the past to imagine the future of elearning

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The conference theme 'learning from the past' invites reflection on educational technology research and development in 30 years since Ascilite began; a period of rapid technology adoption and educational change. Common tools have morphed from static, costly devices requiring qualified programmers to low cost mobile ones that virtually every student in the western world uses daily. The social media 'revolution' is democratizing knowledge creation and sharing. People connect for education, professional and social reasons in ways that were inconceivable in the 1980s. This paper summarizes milestones, and asks how well universities use past experience to understand the present and plan for the future. The wisdom of hindsight is unquestionable, while capacity to predict the future is less certain. Some game changing technologies have come out of left field to knock expectations off the radar. The paper concludes by asking if past experience can really help us prepare for a largely unpredictable future.

Keywords: learning technology research and development, research methods, instructional design, digital literacy, online publishing

Learning technology research in the 1980s

A review of scholarly articles on learning technology from the 1980s reminded me that there were no online journals then. Retrieving an article required either a hard copy of the relevant publication and a photocopier, or an efficient, but lengthy process to request it through an interloan service, where the two physical items were at the far end of a 'snail mail' service. With my large collection of hard copies long ago consigned to the recycle bin, the website for *Review of Educational Research* offered two immediate options to access the article I sought: a) log in through a subscribing institution to access the article for free, or b) 'pay now' per download. Instant online access to library collections may not have made headline news, but was an important milestone for research productivity. Despite my search being for an article published before most journals were available online, a digitized, full text version in an archive was only a few clicks away. Coupled with the web scale discovery services that Vaughan (2012) describes as 'an evolution, perhaps a revolution, for user information discovery from library collections' this technology has shifted the game in a purely positive direction.

The article in question, *Reconsidering Research on Learning from Media* (Clark 1983), relates to fifty years of research, starting with pictures as a labour saving device in learning (Thorndike, 1912 cited in Clark 1983). It is also the source of a much-cited metaphor about learning media - as it was referred to back then - and a grocery truck; the point being that the type of truck used for delivery has no effect on the nutritional value of the food it conveys. The metaphor doesn't work in every case (e.g. refrigeration), and the conclusion that the type of media used to 'deliver instruction' (also 1980s terminology) has no reliable influence on learning may be taken for granted today. In 1983 it was the outcome of three generations of educational research, mainly in the form of meta-analyses and experimental media comparison studies. The statement 'most studies show that media do not influence learning under any conditions' would have been controversial at the time. It was backed by evidence that studies showing gains from media were 'vulnerable to rival hypotheses concerning uncontrolled effects of instructional method and novelty.' Any positive effect disappeared when the same instructor applied different methods. In other words, it was the teacher, the content and the teaching methods that made a difference, not the media. Instructional method, now more commonly referred to as learning design, has been acknowledged as the key to success. Novelty effects are off the agenda 30 years on, as the use of various forms of media (technology) in learning has become commonplace. A further claim that 'biased editorial decisions may favour research showing larger effect sizes' begs the question if similar prejudice might exist today (Gunn & Steel 2012).

In this case, the wisdom of hindsight reveals two things, i.e. that earlier studies focused on questions and used research methods considered limited by today's standards. Meta-analyses were a relatively new approach at the time, and experimental methods belonged to a research paradigm used in physical sciences. When researchers realized that all elements apart from media, including content and methods of instruction, must be identical and sample sizes large enough to balance the effects of individual differences for these methods to work, alternatives had to be sought. This was an early stage in the evolution of educational research methods that continues today. The methods were, like most others, imperfect measures that had to be systematically tested so limitations could be identified, and learning technology research could move on with confidence to devise suitable methods to answer more nuanced, emerging questions.

> If five decades of research suggest there are no learning benefits to be gained from employing different media in instruction, what then should studies aim to investigate? (Clark 1983 p 450)

A decade on, the literature showed new directions that learning technology research had moved in. However, the quest for the holy grail, i.e. the 'best' medium or mix of media to deliver instruction, continued. Some researchers believed it was out there waiting to be discovered, while others adopted more pragmatic views.

Fast forward to 1993

By the early 1990s, the discourse of learning technology had expanded and diversified. Issues in focus then included ways hypertext and hypermedia affect learner interaction with content (Lemke 1993); how multimedia provides a gateway to higher order thinking (Fontana 1993); and if constructivism offers a basis for instructional systems design (Lebow 1993). The fundamental nature of teaching and learning was shifting (Swan & Mitrani 1993) along with the language used to describe it. Laurillard (1993) published the first edition of her seminal work, *Rethinking University Teaching: A Framework for the Effective use of Technology*. Action research was an emergent approach to the systematic improvement of teaching and learning, with or without technology. A raft of qualitative and mixed methods had been added to quantitative and comparative research designs (Robson 1993). Student generated resources (Ryan 1993) and authentic tasks (Honebein et al 1993) were developing as core concepts in instructional design.

While Cobb (1997) and many others argued that computers made no significant difference to learning, Swan & Mitrani (1993) produced evidence that their use could change the nature of teaching and learning at its most basic level, i.e. in interactions between students and teachers. They predicted that the use of computers would lead to more student-centered and cooperative schools, and classrooms where learning is more individualized. Dede, Fontana & White (1993) outlined the nature of the change, noting that multimedia systems could foster a model of teaching and learning with learner driven creation of knowledge through a process of formal enquiry. They proposed using features of the available media to develop metacognitive skill in learners. Metacognitive skills and learning styles were prominent terms. Some instructional designers tried to identify individual styles and direct students to versions of courseware suited to that style. This early attempt to develop recommender systems hit a snag when research showed that learning style is not a fixed attribute, but one that varies in the same student according to influences such as teaching strategy and study context. A parallel can be drawn between learning styles research and studies on learning from media ten years before, i.e. the concept had to be explored before its potential and limitations could be fully understood.

The decade between 1983 and 1993 was more eventful than the previous five decades of research in learning from media. Researchers no longer counted the number of computers in schools, but took for granted that access was available. As a point of historic note, American public schools had 1 computer for every 25 students in 1993. Like the novelty effect of technology in the classroom, the value of counting machines was overtaken by more pressing issues. One such issue was the option to publish in electronic rather than print journals, as an extract from a conversation on the American Educational Research Association mailing list relates:

> \> Gene: what has been your experience with your electronic journal, especially regarding publication credit?

> Brian: too soon to tell, but people are leery to be sure… who knows what some nit-picking, hide-bound committee of mediocrities might haul off and do with one's tenure application. I find older people with established reputations are more willing to publish in the electronic medium.

The caution around a fundamental shift in the high stakes activity of publishing was understandable. With hindsight, economic and access considerations won through, and online journals have become the norm. What was not anticipated is the economic twist of open access journals charging authors to put their articles through a peer review process and make them available online. The cynics among us wonder if this is simply an attempt to retain profits from institutions whose employees assign intellectual property rights to a third party, who then sells it back to them at considerable cost! There are, of course, many more positive aspects to online publishing.

Lessons learned with hindsight from the 1990s are that synergies between technology and emergent pedagogies did indeed begin to change the nature of teaching and learning at its most basic level. However, the shift didn't occur in isolation any more than the effects of particular media on learning could be isolated and measured. Changing institutional circumstances, increased size and diversity in classes, and evolving understanding of learning combined to drive developments in the use of technology for learning. The affordances of technology are recognized as a powerful enabling force, without which many developments could not have evolved. In the decade to 1993, work to improve reliability, usability and human computer interaction design was prioritized. The benefits of this are evident in the intuitive style and ease of use of the current generation of elearning tools.

Computers in learning in 2003

Another decade on, the issues in focus were broader and more diverse. The potential of computer-mediated communication for learning had been theorized and endorsed (Benseman 2000); the issue of gender inequality in online learning identified as a function of culture (Gunn et al 2003). Progress on computer-aided assessment tools and strategies was a productive response to the pressure of scale and diversity in classes (Sangster 2003). Design-based research was emerging to fill gaps left by experimental, case study and action research methods (van den Akker et al 2006). This milestone in learning technology research introduced theoretical grounding of learning designs and ended research cycles with reflection on generalization. The method supports naturalistic inquiry to explore authentic learning contexts, but adds two key elements that were missing from many case studies published in the 2000s, i.e. explicit theoretical grounding of designs and attempts to generalize findings.

Investment in technology had become a major budget item for universities. A momentary distraction occurred when a sector recovering from the 'Y2K bug' and a rash of failed online-for-profit universities got excited about a 'learning object economy', which promised to generate repositories of reusable content in various forms. The idea was great in principle, but failed to fly, most probably because learning objects were neither adaptable nor easily accessible (Gunn et al 2005). Another possibility is that no one was ready to release their best resources into the public domain. The rise of open content and an open education movement was still a few years in the future. Another emergent issue was the use of online learning management systems (LMS) (Morgan 2003). Hindsight shows these systems are more useful for course administration than learning design. Calls for more flexible and sophisticated technology with better content management and groupware functions have yet to be answered. Rapidly rising price tags noted in the early years have, however, continued their upward trend!

A topic that resurfaced at this point was the challenge of sustaining innovative elearning systems and practices (Wiles & Littlejohn 2003). It was noted early on that only a small percentage of academics and courses were involved in elearning in meaningful ways (Darby 1992), and that initiatives supported by grant funding stalled when dedicated resources ran out (Harvard 2003). The mantra that elearning fails to enter the mainstream is still common today and the challenge to sustain grass roots innovations persists (Gunn 2010). The process of operationalizing innovations is slow, and institutions continue to play little or no active part in it.

Conclusions – 2013 and beyond

If it took five decades of comparative studies to realize that medium was being confounded with method of instruction, what might be the sticking points of learning technology research today? It must have been exciting to believe that media attributes could produce unique cognitive skills. The truth was disappointing; that media elements such as animation or simulation facilitate learning in some circumstances, but are neither necessary conditions nor guaranteed to work in all cases. This echoes the findings of research in various other areas of elearning over the past 30 years, and more will no doubt be added in future. A positive outcome is that some technologies do gain traction, if not always in the ways that were anticipated. End users often find purposes for

tools that developers never imagined. Lecture recording is a good example, where potential was underestimated for students who find recordings useful for a range of purposes, and overestimated for faculty who feared being replaced by recordings. In fact, attendance at live lectures has increased in some cases, while recordings allow more time to engage with students in others. MOOCs are the latest major development with an uncertain future and unexpected benefits already emerging, e.g. access to quality resources for use in other courses. Predictions about a structural shift in the higher education sector may yet be realized. A down side of the commodification of higher education over the past 30 years is the falling value of degree certificates and concurrent rise of applied knowledge and skills, regardless of where they were acquired and how they are accredited.
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This brief overview of 30 years of learning technology research and development reveals topics that have faded from view, as well as others that remain part of the evolving discourse. In the past decade, virtual worlds, social media, blended learning, eportfolios, social networks and strategies to disseminate innovations and engage more people in their use have contributed to the university elearning experience with varying degrees of success. Digital literacy, pedagogy for a digital age and pedagogy 2.0 are current terms; student generated resources, peer assessment and new forms of technology enabled collaborative learning are at the leading edge. Rather than becoming redundant as 'prophets' at the turn of the 21st century foretold, universities are adopting new technologies and adapting to changing circumstances in interesting and suitably cautious ways. The evolution of research methods for the field of learning technology continues to provide a strong evidence-base for knowledge in the discipline, including great ideas that crashed as well as ones that continue to fly.

A less desirable element that seems to persist is the ability of large advertizing budgets and slick sales pitches to set unrealistic expectations and sell untried technology tools to institutes of learning. The affordances of some tools will no doubt prove transformational, but the speed and eventual impact will fall short of expectations. The belief that all of them will transform practice has repeatedly been exposed as unrealistic, electronic whiteboards and Second Life being recent cases in point.

Another thing that hasn't changed much in 30 years is the sector's inability to learn from the past. Perhaps the principle of learning from experience means that every path has to be followed to the point of realization that it isn't actually leading anywhere. If we take findings of earlier research for granted today, and acknowledge the journey it took to get here, what will researchers take for granted in 2043 that the sector is grappling with today? One can only wonder what will seem quaint or even slightly ridiculous about the major issues of today?

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Applying Web-conferencing in a Beginners' Chinese Class

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The development of new technologies and the falling cost of high-speed Internet access have made it easier for institutes and language teachers to opt for different ways to communicate with students at a distance. The emergence of videoconferencing applications, which integrate text, chat, audio/ video and graphic facilities, offers great opportunities for language learning to through the multimodal environment. This paper reports on initial data elicited from a pilot study of using web-conferencing in the teaching of a first year Chinese class in order to promote learners' collaborative learning. Firstly, a comparison of three conferencing tools was conducted to determine the pedagogical value of the web-conferencing tool-Blackboard Collaborate. Secondly, the evaluation of 10 campus-based Chinese learners who conducted three one-hour online sessions via the multimodal environment reveals the users' choice of modes and their learning preference.

Keywords: Computer Mediated Communication (CMC), online Chinese teaching, web-conferencing

Introduction and background

For course designers, developing effective language teaching environments are mainly based on Second language acquisition (SLA) theories. The same is true of the development of computer-assisted language learning (CALL). Nowadays, with the rapid development of online teaching technology, and escalating bandwidth capabilities (Hrastinski, 2008), Internet-based synchronous videoconferencing applications are available for teachers use to overcome the geographical challenges of students at a distance and real time oral and visual communication (Wang, 2008). However, applying synchronous communication tools in teaching practice does not automatically lead to successful acquisition since there are other factors involved in the process of interaction (Hauck, 2007; O'Dowd & Ritter, 2006; Pellettieri, 2000). As a consequence, there is an urgent need to investigate the influence of the new technologies on students learning experience and to evaluate the pedagogical value of the web-conferencing tool from both the learners' and instructors' perspectives. This study aims at trialing the web-conferencing platform- Blackboard Collaborate and to find out the answer to the following questions: what are the technological capability and pedagogical values of Blackboard Collaborate? What are the users' evaluations of the tool and what are their learning preferences?

Literature review

Computer Mediated Communication (CMC) and Distance Language Education (DLE)
During the last decades, DLE has experienced dramatic changes and shifts in its delivery approach from tailored materials and one-way interaction tools to multimodal tools. In consonance with this, the research focus has also shifted from learner independence to collaborative learning (Hampel, 2012). This has resulted in the significant development of CMC, which has been transformed from predominantly asynchronous written communication to synchronous multimodal communication (Stockwell, 2007). During the last decade, audio/videoconferencing tools (e.g., Skype, Flashmeeting, Elluminate, Blackboard Collaborate, Netmeeting, BigBlueButton, etc.) have become available and accessible for language instructors. The current literature has shown that

videoconferencing applications have a great potential in stimulating learner-to-learner interaction (Wang, 2004), facilitating collaborative learning (Bower, 2008; Wang & Chen, 2012) and increasing learners motivation and learning outcomes(Jauregi & Bañados, 2008)

Multimodality

There have been a number of researchers who have advocated the application of the combination of different modes in CALL and suggested its strong usefulness in language learning and teaching (Jewitt, Kress, Ogborn, & Tsatsarelis, 2001). Kress and van Leeuwen (2001) defined multimodality as:

> the use of several semiotic modes in the design of a semiotic product or event, together with the particular way in which these modes are combined-they may for instance reinforce each other […], fulfill complementary roles […] or be hierarchically ordered (p. 20).

They further give the definition of communication as "a process in which a semiotic product or event is both articulated or produced and interpreted or used" (p. 20, emphasis in original).

Multimodality not only offers several parallel channels of access to information, but also offers a platform that allows users to interact and to manipulate these representations. Although an increasing number of studies focus on multimodal environments, such as audio/videoconferencing applications, "there is a lack of research that examines the impact of this combined use of tools on interaction and analyses multimodal communication in an online language classroom" (Hampel & Stickler, 2012, p. 119). This pilot study will identify the pedagogical values of the web-conferencing tool-Blackboard Collaborate by comparing it with other popular conferencing applications, and provide in-depth sight on learners' evaluation of the multimodal environments.

Context: applying web-conferencing in beginning Chinese teaching

As a partnership program of the Faculty Partnership Program (FPP) Project "Developing online capacity in Introductory Chinese Language Units" at Macquarie University, the unit CHN104 Introductory Chinese 1 was chosen to participate in the Learning and Teaching Centre's (LTC) Blackboard Collaborate pilot for Session1 2013. This allowed the unit to integrate the videoconferencing tool--Blackboard Collaborate into the iLearn (Moodle) system to develop capacity and pave the way for applying videoconferencing into Chinese teaching at a distance.

In the first semester 2013, the internal students of CHN104 were introduced to Collaborate via a one-hour online training session in week 4. Following the training sessions Collaborate was used in week 7, 9 and11 for additional one-hour online tutorials. In the one-hour session, warm up activities were conducted in the main room moderated by the tutor. After that, students were allocated to breakout rooms in binaries or triads to accomplish collaborative tasks with partners. In the end, everybody was brought back to the main room and presented their work, followed by the tutor's feedback and corrections.

Methodology

This study aims at evaluating the multimodal platform-Blackboard Collaborate in the context of beginning Chinese class. A qualitative approach was adopted, proposed by Debski and Levy (1999) , Warschauer (2000), and Mercer, Littleton and Wedgerif (2004), to generalise the learners' reviews of Collaborate and their preference of difference modes through participant observation, individual interviews and focus groups. There were 10 first year Chinese language learners at Macquarie University participated in the study; two fortnightly online sessions were conducted. In addition, a comparison of three videoconferencing tools was conducted to identify the technological capability pedagogical value of Blackboard Collaborate (see Figure 1) in online language learning and teaching.

Figure 1: Blackboard Collaborate screen shot

Results and discussion

Comparison of conferencing tools

In order to determine the pedagogical value of Blackboard Collaborate in promoting collaborative learning, comparisons with Flashmeeting, Skype (free and paid version) were conducted. Flashmeeing is a web-conferencing system designed by the Open University. Blackboard Collaborate and Flashmeeting both fall under the category of web-conferencing. Skype is a popular desktop videoconferencing software. It can be seen from Table 1 that Collaborate has various features that support collaborative learning at a distance.

Table 1: Comparison of Three conferencing systems (September, 2013)

	Web-conferencing tools		Desktop videoconferencing tools	
Name	Blackboard Collaborate9	Flashmeeting10	Skype11 (Free version)	Skype Premium12 (Paid version)
Software type	Web-based	Web-based	Install software	Install software
Simultaneous user capacity	No participant limits	Up to 25 people	One-to-one	Up to 25 people
Audio support	Up to 6 simultaneous speakers	1 user can speak at a time	Up to 25 people	Up to 25 people
Video support	Up to 6 simultaneous webcams	√	One-to-one	Up to 10 simultaneous webcams
Polling	√	√	×	×
Emoticons	√	√	√	√
Screen sharing	√	√	One-to-one	Group screen sharing
Recording capabilities	√	√	Plug-in (Evaer) 13 is needed	Plug-in (Evaer) is needed
Send files	√	√	√	√
Breakout rooms	√	√	×	×
Training requirement	Medium	Low	Very Low	Very Low

9 https://www.blackboard.com/Platforms/Collaborate/Products/Blackboard-Collaborate.aspx

10 http://cnm.open.ac.uk/projects/flashmeeting/

11 http://www.skype.com/en/features/

12 12 http://www.skype.com/en/premium/?intcmp=CS-Upsell-FA10868-3

13 http://www.evaer.com/

Learners' evaluation

In the interview and focus group, students were asked about their preferences of different modes and users' experience with Collaborate. Their average rating of Collaborate was 8/10. The main challenge of using Collaborate during the three online sessions was the audio lag (especially in week 9) but by week 11 this had improved. Interestingly, their most frequent used mode was audio rather than video. Their explanation was because they already knew each other from class, whereas, they perceived that it was necessary for the tutor to use the video. Their second favorite modes was the whiteboard, which was essential for online session since it helped students with recognition of the Chinese characters and provided an opportunity to type the characters instead of writing them as they would in class. Some of them also mentioned the raise-up hand button was helpful since it can easily gain the moderator's attention and also comes with a number indicating the order of the waiting queue. "It was a more civilised way instead of everyone just talked at the same time" (quoted from the focus groups). When they were asked to compare the main room and breakout rooms activities, all of them preferred the main room with the reason of they feel more comfortable with tutors assistance. In the end, all of them expressed that they would like to continue with online sessions next semester since they find them engaging and helpful to their Chinese learning in terms of speaking, listening and Chinese character recognition.

Conclusion

This study illustrates the implementation of a web-conferencing tool in first year Chinese language teaching. As part of the pilot study, only the initial data was analysed and interpreted. A more in depth evaluation of quantitative and qualitative data will be conducted and reported in the near future. We are aware of the limitations of this study, in which all the participants are campus-based students. Therefore, their perspectives and concerns might be different from distance learners, for example, they didn't consider visual communication as an important aspect of online sessions. However, since oral-visual interaction plays a key role in DLE (see Wang, 2008), we assume that external students would be inclined to use the video function. To optimise the web-conferencing tool to foster collaborative language learning, and to meet the needs of students with different learning preference and strategies, more research is needed in terms of task design, communication pattern in multimodal environments, learners' strategies, learners and instructors training.

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Academics adopting mobile devices: The zone of free movement

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This exploratory research characterised the degree of adoption of mobile learning (ML) devices among academic staff at an Australian university. It also sought to evaluate the impact of academics' perceptions about possibilities and constraints in the adoption of these technologies. A zone of free movement (ZFM) scale was developed and validated to quantify the magnitude and direction of those perceptions. Results showed that academic staff are characteristically at the third of the Russell's (1995) six developmental stages of technological adoption. Lack of time to integrate ML into courses, limited availability of mobile devices, little familiarity with the tools, as well as the perception that students cannot use them as a word-processor, act as inhibitors to the adoption of the technology. In turn, the perception that mobile tools enhance student-lecturer communication outside class was found to be a positive predictor of adoption.

Keywords: Mobile learning, academics, perception, adoption, implementation

Introduction

Appraising academics' perceptions of the value of educational technologies is paramount to the success of any technological innovation in education. Several studies have found that among academics there are a number of counterproductive beliefs about electronic learning technologies that might hamper implementation (Handal, Groenlund & Gerzina, 2011; Moron-Garcıa, 2002; Newhouse, 1998; Niederhauser & Stoddart, 1994). It is crucial, then, to explore those perceptions and target them through professional development and other institutional implementation programs.

The implementation of mobile technologies for teaching and learning in higher education can be a complex institutional endeavour. Universities and academic staff are under constant pressure to embrace change as these new technologies increase their presence in course delivery. Rather than being a matter of choice, both experienced and novice academic educators are required to adopt these tools in their programmes (Mostakhdemin-Hosseini & Tuimala, 2005). This study articulates the relationship between related variables in tertiary environments and academics' opinions about the stages of ML adoption. It also proposes recommendations to make this adoption process smoother, and more thoughtful and systematic.

Literature Review

Stages of Adoption

Originally identified by Russell (1995) through qualitative research, the stages of adoption scale describes the phases that teachers pass through in order to embrace a learning technology. According to Russell, teachers go through these stages at their own rate of progress and might start at any phase according to their background and life experiences. The stages of adoption scale was adopted to represent the take-up of a learning technology in six developmental phases, namely, (a) awareness, (b) learning the process, (c) understanding and application of the process, (d) familiarity and confidence, (e) adaptation to other contexts, and (f) creative applications to new contexts. These six stages have been outlined in various formats according to the specific learning technology to be used (Christensen, 1997; Handal, Chinnappan & Herrington, 2004; Handal, Cavanagh, Wood & Petocz, 2011). In general, the scale can be represented as follows:

> *Awareness: I am aware that the technology exists but have not used it - perhaps I'm even avoiding it. I am anxious about the prospect of using mobile devices.*
>
> *Learning the process: I am currently trying to learn the basics. I sometimes lack confidence when using the technology.*
>
> *Understanding and application of the process: I am beginning to understand the process of using this technology and can think of specific tasks in which it might be useful.*
>
> *Familiarity and confidence: I am gaining a sense of confidence in using the technology for specific tasks. I am starting to feel comfortable using the technology.*
>
> *Adaptation to other contexts: I think about this technology as a tool to help me and am no longer concerned about this technology. I can use it in many applications and as instructional aids.*
>
> *Creative application to new contexts: I can apply what I know about this technology in teaching and learning. I am able to use it as an instructional tool and integrate it into the curriculum.*

Zone Theory

The adoption of a learning technology can be better understood in the context of the interface between the academic and his/her environment. In other words, research on embracing information and communication technologies (ICT) in education should focus on the interaction between an academic's knowledge and beliefs and the possibilities and constraints surrounding his/her professional environment. For Valsiner (1987, 1997) this learning working space is created by the synergies generated among three main zones, which he outlined as the zone of proximal development (ZPD), the zone of free movement (ZFM) and the zone of promoted action (ZPA).

ZPD was earlier conceptualised by Lev *Vygotsky (1978)* as the gap between a learner's present capabilities and the higher level of performance that could be achieved with appropriate assistance. *ZPD itself can be associated with a set of capabilities in the form of skills and knowledge embedded within the learner, allowing him/her to potentially perform at higher and increasing levels of achievement.* According to *Vygotsky:*

> The zone of proximal development defines functions that have not matured yet, but are in a process of maturing, that will mature tomorrow, that are currently in an embryonic state; these functions could be called the buds of development, the flowers of development, rather than the fruits of development, that is, what is only just maturing (*Vygotsky, 1935, pp. 33-52).*

Applied to the field of learning technologies deployed by academics in higher education, ZPD refers to those capabilities endowing the academic to effectively deploy ICT to advance teaching and learning. It explains academics' ability to efficiently integrate pedagogy, technology and discipline content at various developmental stages of adoption to progressively enhance students' learning experiences.

Valsiner (1987, 1997) added that such dynamics are also influenced by facilitating and hindering factors operating within the same learning environment. In that vein, ZFM was outlined as the enclosed environment in which the individual interacts for teaching and learning purposes. ZFM represents both processes and structures that condition the circumstances in which teaching and learning are enacted. It also represents availability and access to hardware/software, technical support and infrastructure. ZFM includes students' characteristics, perceptions about the role of technology in education, and curriculum and assessment requirements. Furthermore, ZFM elements can be further characterised as a possibility or a constraint factor delineating what can or cannot be done or achieved. For the purpose of this study, these elements have been additionally grouped into operational and pedagogical factors to distinguish their underlying role in the implementation of mobile learning.

In turn, ZPA represented the opportunities for professional growth that the individual can access to advance his/her professional learning in order to achieve students' academic progress (Goos & Bennison, 2007). ZPA stands for those empowering factors aiming at skill development in ICT in education. It also includes participation opportunities in professional development, either external or internal to the university, and chances for collaboration and peer professional learning, including informal individual learning or assistance from colleagues. In general, ZPA corresponds to openings for becoming familiar with ICT and their pedagogies.

More importantly, zone theory permitted a theoretical framework where ZPD incorporates the social setting as another determinant of the learning experience. When associated with ZFM, ZPD works along two other dimensions: possibilities and constraints. *Such continuous advances can be affected by mediating variables either empowering or disempowering the personal espousal and institutional implementation process (Goos & Bennison, 2008).*

If effective teaching and learning is to happen then the ZPD must synchronise with the academic's opportunities for continuous progress (ZPA), as well as operating within a doable working space delineated by the ZFM. This study focused on the ZFM as perceived by academics in regard to possibilities and constraints related to using mobile devices in teaching and learning. It also looked at the interaction of those perceptions with their ML stages of adoption.

Mobile Learning

Mobile technologies have opened the way to a more seamless approach to teaching and learning. This is so not only for the ubiquity and portability of mobile devices such as tablets and smartphones (Sharples, Taylor & Vavoula, 2007) but also because of their capacity to act as teaching hubs both for the individual and a group. Mobile technologies allow users to use these appliances as multiple devices where various teaching tools can be simultaneously accessed (Wong, 2012). In fact, smartphones and tablets permit learners to integrate computational, productivity, simulation, exploration and information retrieval tools in a central hub (Handal, El-Khoury, Cavanagh & Campbell, 2013). Furthermore, learners and instructors are able to immerse themselves dynamically in their learning and teaching tasks and in the virtual world 'anywhere, anytime'. Opportunities for broader online interaction through conversations and quasi real-life scenarios make situatedness a singular characteristic of mobile technologies in the university educational environment (Hwang, Tsai & Yang, 2008). Teaching and learning have been thus extended beyond the university bricks-and-mortar surroundings, opening new academic vistas to tertiary education in the early 21st century. From the learners' perspective, students are bringing their own devices (BYOD) moving away from university proprietary software and hardware and becoming more independent in their digital choices (Wong, 2012).

For the purpose of this study, mobile devices are portable handheld devices providing computing, information storage and retrieval functionalities as well as multimedia and communication capabilities. Mobile devices are available in the market as smart phones (also known as "mobiles") or tablets.

Research Questions

There is evidence of a number of differential effects, traditionally examined in research on the adoption of educational technology among educators, such as gender, employment status, regular access to mobile devices and technology ownership (Handal, Cavanagh, Wood, & Petocz, 2011).These factors, and others such as academics' perceptions of their zone of free movement (ZFM) when adopting mobile technology in teaching and learning, have not yet been explored in-depth in the context of mobile technology in tertiary environments.

The following research questions were adopted in the present study:

i. At which stage of adoption of mobile learning technology do academic staff perceive themselves?
ii. What are the ZFM features when adopting mobile learning, as perceived by academics?
iii. How does
    a. gender
    b. employment
    c. regular access to a smart phone or a tablet
    d. mobile tablets owned by a school/faculty

impact on ML stages of adoption?
iv. Which ZFM aspects influence stages of adoption of mobile technology?

Methodology

Subjects

Subjects for this study were academic staff from an Australian university comprising nine schools. Staff were invited to participate in an online survey through an email providing a dedicated link, followed later by a reminder email. The survey remained online for three weeks.

Instrument

A ZFM scale was designed to measure educators' stages of adoption and attitudes towards mobile learning technologies (Tables 1, 2, 3 and 4). Stage of adoption of mobile learning was determined through an adaptation of Russell's scale (1995) outlined in the Teachers' Attitudes toward Information Technology Questionnaire (TAT) version 2.0. The TAT modified version includes a number of explanatory and response variables for further statistical analysis (Handal et al., 2011).

The explanatory variables for this study were associated with the ZFM in mobile learning in higher education. A scale of thirty-two ZFM items was designed which included 16 ML possibilities and 16 ML constraints. In turn, each of these two groups was subdivided into 7 pedagogical (teaching and learning) and 9 operational (technical) categories. The items were created by the researchers or adapted from previous questionnaires appraising students' and academics' perceptions on ML (Al-Fahad, 2009; Bradley & Holley, 2010; Handal, Groenlund & Gerzina, 2011; Goos & Bennison, 2007, 2008; Hamza Hussein & Bassam Nassuora, 2011; Khwaileh & Al-Jarrah, 2010; MacCallum & Jeffrey, 2009; Oliver, 2005; Yang, 2012). The items, displayed with their arithmetic means in tables 1-4, are indicative of the major ML possibilities and constraints identified in the literature.

The dependent variable was teachers' stage of adoption. To further explore the impact of those thirty-two items on stage of adoption, other demographic and environmental variables were included such as gender, UNDA school/campus, employment status, regular access to mobile devices and mobile technology available. Responses to the open-ended items of the questionnaire explain the instructional, curricular and organisational contexts of the mobile learning implementation process and are discussed elsewhere (Handal, MacNish & Petocz, in press).

Data Analysis

Response Rate

The final response rate was 17% (N =177). While there is no definite answer as to an appropriate response rate for online surveys (Nulty, 2008) it is noteworthy that despite its apparent low rate the internal reliability coefficient resulted in an acceptable and moderately high alpha of 0.707. Similarly, the subsequent principal component analysis proved the structural worth of the ZFM scale by identifying two distinctive factors. Likewise, the gender participation ratio was almost balanced, 43% and 57% for females and males respectively. A similar balance was achieved for employment status where 48% and 52% of the respondents were part and full time, respectively. The above figures add consistency to the sample and strengthen the results. The percentage of female academics and full-time academic staff was about 51% and 26%, respectively.

Descriptive Statistics

Scores were used to compare responses to individual ZFM scale items. All responses were coded in a 3-point Likert scale: *agree*, *undecided* and *disagree*. In general, scores less than 2.0 were examined on a continuum ranging through *low* to *slightly below average* while scores greater than 2.0 represented a continuum ranging from *slightly above average* to *high*. A score of 2.0 would indicate an orientation that lies midway in a particular opinion. The item stem was: *In my opinion, mobile devices present the following capabilities and constraints in teaching and learning ...*

Respondents tended to agree with all nine statements related to operational constraints, as shown in Table 1. The statement with the highest mean score of 2.87 was "Sometimes the connectivity is poor in some areas" (OC7) with a standard deviation (SD) of 0.37, indicating a fairly strong and coherent agreement. The OC7 variable was followed by "Not all students or lecturers have mobile devices or are not in the habit of using them" with a mean score of 2.68 and an SD of 0.63. This indicates that devices are not generally being used for teaching and learning, and are not yet embedded into the fabric of the university. A critical mass might be needed to get pedagogical value for mobile technologies. The primary operational constraints therefore are perceived lack of connectivity and perhaps related to this the tendency of staff and students not to use their mobile devices.

Table 1: Operational constraints (OC)

Variable	Operational constraints	Mean	*SD*
OC7	Sometimes the connectivity is poor in some areas	2.87	0.373
OC8	Not all students or lecturers have mobile devices or are not in the habit of using them	2.68	0.627
OC9	Have restrictions on screen size and resolution	2.52	0.674
OC5	Internet connection outside the University and home network can be expensive –lack of wifi in many locations	2.46	0.767
OC4	In a fast moving market mobile products can be out of date very quickly	2.32	0.747
OC3	Do not offer the same interface richness/immersiveness compared to a laptop/desktop	2.18	0.768
OC1	Apps do not work across main mobile platforms	2.11	0.655
OC2	Data storage capacity is limited	2.07	0.786
OC6	Lack of a mouse and a keyboard makes usability difficult	1.83	0.842

There was general agreement with the statements in relation to pedagogical constraints (see Table 2 below). The variable with the highest mean score of 2.58 highlighted the need for teachers to have more pedagogical support on how to integrate mobile learning. Further, there was high agreement with the statements about special curriculum tasks being required to support the use of mobile devices (PC3) and the lack of time to integrate mobile learning (PC7), both with mean scores of 2.46. Variable PC1, concern that the students will cheat using mobile devices, with a mean score of 2.06, had the highest standard deviation of the survey at 0.87 suggesting a wider range of opinions. It is noteworthy that while the mean scores for operational constraints varied from 1.83 to 2.87 the mean scores for pedagogical constraints ranged from 1.92 to 2.58, on the three-point scale. These results suggest that respondents were overall more concerned with operational constraints than pedagogical constraints.

Table 2: Pedagogical constraints (PC)

Variable	Pedagogical constraints	Mean	*SD*
PC6	There are not many formal opportunities to learn about mobile learning	2.58	0.659
PC3	Special curriculum tasks to support the use of mobile devices are required	2.46	0.713
PC7	Lack of time to integrate mobile learning into my course	2.46	0.744
PC4	Students do not adequately know how to use them for their learning	2.32	0.727
PC5	Students will be distracted in class	2.31	0.781
PC1	Concerned that students will cheat using mobile devices	2.06	0.867
PC2	Reduce lecturer student personal contact	1.92	0.835

There was high agreement with the statements in relation to operational possibilities (see Table 3 below). Many staff members felt that mobile devices would make the operational life of both lecturers and students easier; for example, carrying of digital curriculum related files (mean 2.82), studying in times and locations that suited individuals (mean 2.81), accessing online resources (mean 2.79), personal study notes (mean 2.68) and organising tasks (mean 2.67). Overall, the respondents perceived operational possibilities in mobile technologies for users, both lecturers and students.

Table 3: Operational possibilities (OP)

Variable	Operational possibilities	Mean	*SD*
OP1	Allow easy physical carrying of digital curriculum-related files (e.g., PDF, Word, PowerPoint, course notes)	2.82	0.480
OP2	Allow students and staff working at own time and location that suit them	2.81	0.484
OP7	Improve access to online teaching resources (e.g., internet browsing, podcasting, online Library catalogue, Blackboard, virtual galleries)	2.79	0.527
OP9	Let students write and save their own personal study notes	2.68	0.619
OP3	Assist lecturers and students in organising their course tasks (e.g., calendars, diaries, timetables, reminders)	2.67	0.576
OP4	Empower lecturers and students in producing multimedia presentations through taking their own pictures or recording audio and video footage	2.62	0.611
OP8	Keep students constantly connected to the course content and developments	2.56	0.672
OP5	Enable students to record lecture presentations or any other course learning experience	2.50	0.704
OP6	Facilitate educational management of marks, attendance and students records	2.37	0.714

Again, there was high agreement with the statements in relation to pedagogical possibilities (see Table 4). There was strong agreement in the potentiality of mobile technology facilitating learning anywhere and anytime (mean 2.72), individualised instruction (mean 2.68) and collaboration and interaction among students (mean 2.61). Changing technologies and pedagogical strategies may require teachers to join communities of practice where they can share ideas. Operational possibilities had mean scores ranging from 2.37 to 2.82, while those for pedagogical possibilities varied from 2.31 to 2.70. Differences in the maximum values from both sets suggest that respondents put a greater value on ML electronic affordances for tasks that might not be directly instructional related.

Table 4: Pedagogical possibilities (PP)

Variable	Pedagogical possibilities	Mean	*SD*
PP7	Facilitates independence in learning anywhere and at anytime	2.72	0.570
PP4	Offer greater possibilities for distance remote learning and individualised instruction	2.68	0.549
PP2	Facilitate collaboration and interaction among students	2.61	0.646
PP6	Educational apps empower students to explore new concepts, simulate real-life situations, collect data or practice content	2.58	0.631
PP5	Permit real-time learning interactions in class (e.g., resource sharing, surveys, questions)	2.56	0.671
PP1	Enhance student-lecturer communication beyond class time (e.g., email, SMS, file sharing, quizzes, feedback, updates, discussion forums, social networking)	2.46	0.767
PP3	Increase communication with colleagues	2.31	0.779

Principal Component Analysis

The principal component analysis (PCA) aimed to show how the ZFM scale items fit with each of the two scales by the way respondents discriminated items across the two scales. It was anticipated that there are might be subtle differences between the two constructs, namely, possibilities and constraints.

The procedure for selecting semantic items for the ZFM scale was based on item scale reduction. Items with loadings between -0.4 and 0.4 were considered for inclusion in the final scale. A Cronbach's alpha coefficient of 0.703 for the ZFM scales was obtained. This is a measure of inter-item correlation expressing the internal consistency of the instrument. The literature suggests that internal reliability coefficients higher than 0.60 are acceptable (Litzelman, Stratos, Marriott, & Skeff, 1998). The two-factor solution extracted 34.5% of the variance using Varimax rotation for the ZFM scale. The eigenvalues of the two factors from the principal component were all larger than one. The factor analysis of the ZFM scale clearly identified the possibilities as one dimension and the constraints as another dimension. Table 5 shows the PCA results:

Table 5: Rotated component matrix of ZFM scale

Components					
Item	1 (Possibilities)	2 (Constraints)	Item	1 (Possibilities)	2 (Constraints)
OC1		0.459	OP8	0.735	
OC2		0.556	OP9	0.523	
OC3	-0.360	0.547	PC1		0.443
OC4		0.540	PC2		0.449
OC5		0.511	PC3		0.492
OC6	0.388	0.466	PC4		0.484
OC7		0.464	PC5	-0.341	0.412
OC8		0.587	PC6		0.445
OC9		0.528	PC7		0.545
OP1	0.341		PP1	0.620	
OP2	0.597		PP2	0.686	
OP3	0.606		PP3	0.536	
OP4	0.641		PP4	0.712	
OP5	0.494		PP5	0.727	
OP6	0.522		PP6	0.585	
OP7	0.716		PP7	0.784	

The only cross-factored item identified was OC6 ("Lack of a mouse and a keyboard makes usability difficult"). A subsequent analysis of the ZFM scale when the OC6 item was deleted yielded an increase of Cronbach's alpha from 0.703 to 0.714 and an increase in the scale variance from 34.5 to 44.7. Hence, it can be safely removed from the scale, although a recommendation could be made to leave the item on the scale as it correctly loads more on the constraints rather than on the possibilities construct. Such loadings might also imply that lack of a mouse and keyboard might be perceived both as an advantage and disadvantage or, in other words, a matter of personal preference difficult to establish statistically. Finally, when each subgroup of the ZFM scale (e.g., OP, OC, PC, PP) was analysed then one dimension was identified, confirming the scale division into possibilities and constraints.

Regression Analysis for Sub-Group Averages

An early analysis using stages of adoption as the dependent variable and the remainder of the questionnaire questions as explanatory variables revealed that only significant predictor was the variable 'Access', represented by the questionnaire item *"I have regular access to a smart phone or a tablet"* ($p = 0.006$). In a subsequent regression analysis, average responses were calculated for each of the groups (OC, OP, PC, PP) to be used as potential predictors, along with Access, which is significant. In that model, average OC is significant ($p=0.001$), average PC could be considered marginal ($p=0.09$) and average OP and average PP are not significant, while Access has $p<0.001$. Average OC has a Beta = -1 meaning that for one unit increase on the subgroup there is a corresponding one unit decrease on the stages scale. Results are shown in Table 6.

Table 6: Multiple regression using sub-group averages

Variable	Beta	Std. Error	*T*	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	6.152	1.274	4.830	.000	3.634	8.670
Access	1.009	.268	3.769	.000	.480	1.538
Average OC	-1.096	.338	-3.247	.001	-1.764	-.429
Average OP	-.438	.479	-.916	.361	-1.384	.508
Average PC	-.557	.327	-1.704	.091	-1.203	.089
Average PP	.574	.403	1.427	.156	-.221	1.370

Dependent Variable: Stage of adoption

Stepwise Regression Analysis for ZFM Scale items

At the item level, all questionnaire items were entered into the multiple regression analysis allowing for the selection of significant predictors stepwise. This had the nice outcome that, as well as Access (p<0.001), exactly one item was selected as significant from each of the four groups: PC7 ("Lack of time to integrate into course') (p<0.001), OC8 ("Not all students/lecturers have devices") (p=0.004), PP1 ("Enhance student-lecturer communications outside class") (p<0.001) and OP9 ("Students can write and save own notes") (p=0.026). Results are shown on Table 7.

Table 7: Stepwise multiple regression by items

Variable	Beta	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
(Constant)	4.888	0.810	6.037	0.000	3.287	0.6489
Access to Device	1.031	0.256	4.025	0.000	0.524	1.538
PC7	-0.543	0.151	-3.591	0.000	-0.842	-0.244
OC8	-0.496	0.170	-2.913	0.004	-0.833	-0.159
PP1	0.576	0.143	4.023	0.000	0.293	0.859
OP9	-0.380	0.169	-2.258	0.026	-0.714	-0.047

In general, an increase of one unit on those four opinions would cause about half a unit variation on the stages scale. For three of them the effect will be negative: PC7 ("Lack of time to integrate into course"; Beta = -0.543), OC8 ("Not all students or lecturers have mobile devices or are not in the habit of using them"; Beta = -0.496) and OP9 ("Let students write and save their own personal study notes"; Beta = -0.380). The negative coefficient is unexpected, and will be discussed later. In turn, PP1 ("Enhance student-lecturer communication outside class") will yield a positive effect on the stages of adoption scale.

Stages of Adoption

As shown in Table 8, a quarter of respondents indicated that they were in the third stage of adoption of mobile devices: *Understanding and application of the process: I am beginning to understand the process of using mobile devices and can think of specific tasks in which it might be useful.* This was also the modal response; the full range of stages was reported, with lowest frequencies in the two extremes.

Table 8: Response to stages of adoption items

Stage	Percent
1. Awareness	12
2. Learning the process	19
3. Understanding and application of the process	24
4. Familiarity and confidence	16
5. Adaptation to other contexts	19
6. Creative application to other contexts	10

Discussion

Stage of Adoption of Mobile Learning Technology as Perceived by Academics

At this university, academic staff scored on average at the third of the six points of the ML adoption scale: *Understanding and application of the process: I am beginning to understand the process of using this technology and can think of specific tasks in which it might be useful.* Recommendations are incluced in this study to go beyond the midway point and attain the fourth stage, which is: *Familiarity and confidence: I am gaining a sense of confidence in using the technology for specific tasks. I am starting to feel comfortable using mobile devices.*

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The descriptive analysis of arithmetic means for the four sub-group ZFM scale provides valuable indications about what academics think as a cohort about each ML possibility and constraint factor. They believe that an efficient Wi-Fi connectivity is paramount to the success of any ML innovation (Melhuish & Falloon, 2010). They are also of the opinion that a major constraint is students' and academics' limited access to mobile devices as well as their limited familiarity with the complex functionalities of technology devices (Schuck, Aubusson, Kearney & Burden, 2012).

Lack of professional development as to how to incorporate technology into content and pedagogy, as reported by the participants in this study, can hinder effective integration, an observation supported by Yang (2012). As with operational and pedagogical possibilities, academics regarded ML devices as vehicles to enhance autonomous learning, to allow ubiquitous course engagement and to promote collaboration beyond university walls (Hamza Hussein & Bassam Nassoura, 2011). Similarly, staff were appreciative of the tools' portable ability to store and access teaching related files. What did not come through very strongly was their concern for using devices to articulate specific learning and teaching activities through touch screen experiences such as educational app or multimedia resource creation, as well as other interactive functionalities like real-time interactions in class, online forums or online quizzes (Kukulska-Hulme & Pettit, 2009).

Impact of Differential Variables on ML Stages of Adoption

Interestingly, gender, employment status and number of tablets owned by each School were not found to be significant explanatory variables in regard to stages of adoption. The statistical significance of responses to the item *"I have regular access to a smart phone or a tablet"* tell us how important it is for lecturers to have constant contact with an ML device to develop familiarity and confidence (MacCallum & Jeffrey, 2009). This finding suggests that universities should ideally provide those tools to lecturers for training, on loan or via bulk purchases at competitive prices for staff acquisition.

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PC7 ("Lack of time to integrate into course") and OC8 ("Not all students or lecturers have mobile devices or are not in the habit of using them") emerged as significant explanatory variables of stages of adoption (Oliver, 2005). These logistics issues appear often in various studies on mobile learning implementation. ML requires lecturers to develop new approaches and resources, adding pressure to their workload and other demands such as research and administration (Ting, 2012). For example, investigating quality educational apps to demonstrate disciplinary concepts requires individual time, as well as time spent liaising with eLearning staff and engaging in a trial-and-error learning exercises (Johnson, Adams Becker, Cummins, Estrada, Freeman, & Ludgate, 2013). Similarly, some staff and students are still using first-generation mobile phones that do not have an Internet display and other more elaborated electronic affordances that can be used pedagogically. Mobile tablets are still out of the reach of students' budgets, limiting their familiarity with the tool.

For the surprising OP9 negative explanatory effect ("Let students write and save their own personal study notes") one would argue that lecturers might think that students writing and saving their own notes was a mixed blessing — such responses might represent lecturers' acknowledgement that the word-processing capabilities are underrated as compared to more complex desk/laptop software such as Office Word or Excel (Marmarelli & Ringle, 2011). Lecturers might even think that learning materials are not compatible with mobile formats. It might also be that lecturers feel that students are not paying attention when students look at their ML screens (Barnes, & Herring, 2011).

Operational constraints as a subgroup also had a negative explanatory effect on the stage scale. Interestingly, while 78% of the participants stated that they possessed a smart phone or a mobile tablet, 74% indicated that their schools owned only 0-5 mobile tablets, reflecting a lack of availability of this technology. Only 21% of the participants owned a mobile tablet, with brands varying within a broad range of commercial products, almost half of them being Apple iPad users.

Finally, PP1 – the only positive effect – represented a widely acclaimed feature of ML to improve student-lecturer communication beyond the lecture walls (Khwaileh & Al-Jarrah, 2010). Mobile devices through email, SMS, file sharing, quizzes, feedback, updates, discussion forums and social networking are powerful tools in broadening 24/7 communication channels at a distance between students and lecturers and among students themselves (Bradley & Holley, 2010).

Conclusion

In a time when academics and students are increasingly utilising their mobile devices and interfacing them more seamlessly with the University electronic equipment, it is apparent that technology is becoming more integrated with learning and teaching. This is so not only for procedural purposes such as up/downloading resources or emailing but also for curricular and instructional reasons. Such a merging has profound implications for course delivery and the student experience. Academics are gradually required to provide more resources that are in line with the multimedia features of digital resources. To their advantage, these resources incorporating image, audio and animation can be played on students' BYOD devices in their own time and place. Universities are also progressively adapting their mobile digital infrastructure to accommodate students' needs and to facilitate academics' work. The findings of this study are significant because they identify academics' perceptions of a seemingly fluid and complex landscape contextualised within their own zone of free movement. Such data are relevant to guide professional development and policy in order to enhance the student experience.

The conclusions of the present study are valuable to the process of implementing mobile learning in tertiary education from a ZFM perspective. As the university prepares to introduce a new version of Blackboard through mobile technology, this study characterises a broad range of issues contributing to ML implementation during such a transition context. It was thought that such a transition environment would present a unique context for appraising academics' beliefs. In general, respondents to the survey seemed to have seen the benefits and potential of mobile learning technologies but were cautious about implementing them due to a lack of confidence in the infrastructure.

As a result, this study has extended the existing body of literature on implementing mobile learning technology in higher education particularly on methodology and research design. The use of multiple regression analysis provided a statistical avenue to explain the influence of environmental variables on stage of ML adoption, complementing well with descriptive data. The ZFM scale developed in this study is structurally solid and can be used in other higher education institutions that, as part of ongoing implementation processes, would like to appraise their academic staffs' perceptions of possibilities and constraints of ML devices in teaching and learning. Although generalisation is an issue because of the limited response rate of 17% , due to the scale's appropriate internal reliability and the composition of the participant group, the instrument is able to provide meaningful data to other tertiary institutions. Valsiner (1987, 1997) explained that "ZFM is a means to an end, rather than an end in itself" (1987, p. 190). Hence, the evidence generated can be used to reconstruct the ZFM through professional development, challenging academics' misconceptions on ML, enhancing the IT infrastructure and support, providing access to technology and producing creative policies.

Professional development workshops should target both healthy beliefs problems as well as misconceptions about possibilities and constraints in using mobile learning (Li & Walsh, 2010). For example, in order to promote positive attitudinal beliefs to increase level of adoption, inservice could put more emphasis on the communication and associated issues provided by ML devices (Pollara & Broussard, 2011). Similarly, clarification will be needed on the type of functionalities allowing students to directly make and take notes both during lectures or tutorials and in their private study. More importantly, emphasis should be made on training staff in articulating teaching experiences at the discipline level that take into account the dynamic affordances of mobile devices. Also effective would be creation of professional development networks within the university, both formal and informal, to share ideas that will help to alleviate academic workloads and yet integrate mobile learning into course delivery (Schuck et al., 2012). Such activities will certainly enhance the zone of promoted action (ZPA) as described by Valtimer (1987, 1997) and Goos and Bennison (2007, 2008).

Further longitudinal research as to how these opinions evolve during implementation, through professional development, policy-making, technology access and enhanced IT infrastructure, can provide clearer clues on the impact of the explanatory variables. Such prospective research should evaluate the interaction of those variables with instructional, curricular and organisational contexts operating within each discipline.

In general, the study reflected a healthy set of beliefs that need to be harnessed to efficiently implement the use of mobile devices in teaching and learning using the ZFM framework. As an academic stated in the comments section of the questionnaire: "The horse has already bolted. We need to catch it or we'll be out in the paddock without a horse."

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Accessible, reusable and participatory: Initiating open education practices

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How does a university get started with open educational resources (OER)? What institutional tensions and conflicts are likely to be brought into play during this process? The promise of OER for higher education offers more than unrestricted access to high quality knowledge, it implies open and transparent sharing and development of knowledge, that is, integrating the disparate parts of the university through the shared activities of open education *practices* (OEP). In this paper we investigate how a range of disparate participants organised to establish initial OEP processes in an Australian university in order to embed an open education agenda: setting up repositories and processes for open publishing of educational design, and negotiating agendas of marketing and openness. We attempt to identify the groundwork at the meso-level of the organisation in order to establish OEP; in other words, to identify *what comes before* any actual resources are produced or made available.

Keywords: open educational resources, open education practices, curriculum design, publishing, repositories

Introduction

In the history of disruptive technologies that have promised transformative shifts in higher education, forms of open education arguably demonstrate the greatest departure from traditional education with its regime of bounded knowledge and individualised learning, and the enactments of sharable, adaptable communities of learning. Open educational resources (OER) has its origins in developments in the late 20th century in open education associated with the open source movement, and the term arose from UNESCO in 2002 (Geser 2007; Weller 2011; Bossu et al. 2012). Recent visionary reports on open education indicate the significance of this shift to openness and the need for an integrated, rather than bounded, approach by higher education institutions. The OLCOS Roadmap (Geser 2007) recommends that organisations "foster open practices of teaching and learning" (p. 12) with a view to "leverage education and lifelong learning for the knowledge economy and society" (p. 12). The OPAL Report (2011) advocates shifting focus from resources to practices, or open education practices (OEP), throughout the institution, including a supportive policy environment and strategies with "cultures of innovation" that encompass institutional frameworks, repositories and practices of sharing and reuse. The Horizon Report on higher education (Johnson et al. 2013) notes the shift in educational values from "authoritative sources" (p. 7) to openness and transparency, with the expressions of these values still taking shape. The first of their list of "key trends" notes that "[a]s authoritative sources lose their importance, there is need for more curation and other forms of validation to generate meaning in information and media" (p. 7). OER, therefore, is the locus of convergence for institutional strategies, technologies, and practices of teaching and learning, and the implication of these reports are that OER cannot be implemented partially within a university.

In the Australian higher education context, Bossu et al. (2012) describe a range of developments with OER in universities, noting some universities have clear strategies for OER, but that many others reflect nascent moves in this direction. In their survey of Australian universities she notes both a "lack of OER uptake" and a "lack of institutional support" (p. 130).

These and other accounts (Conole, 2013; D'Antoni 2009; Baraniuk & Burrus, 2008) discuss the issues and challenges in the development of institutional frameworks, policies, and arrangements for OER in higher education, and the enablers and inhibitors to OEP. We suggest that the embedding of OER & OEP is more than interoperability of institutional structures and technologies. Perhaps the transformative implications are captured by Neary & Winn (2009), who propose that open and collaborative initiatives are more than a call to simply redesign curriculum, but to "redesign the organizing principle, … through which academic knowledge is currently being produced". In other words the implication of OER & OEP is to "refashion the university" through new relations between academic, public and knowledge creation.

In this paper we adopt a particular orientation to the work of establishing OER and OEP: the university as a complex organisation, consisting of interconnected but disparate parts. We focus on the work required to get started with OEP in an Australian university; the key arrangements and practices, that is, OEP, that need to be put into place in order to establish the necessary conditions for OER. This paper offers an account of these initial steps by participants that are distributed across the meso-level of a university: practitioners working in curriculum teaching and learning; in digital repositories, in electronic publishing, and in university policies and procedures. We argue that embedding OEP cannot be achieved by proceeding in a "business as usual" manner, with OER as "bolted-on" to existing learning technology systems or information repositories. Rather, OEP entails a fundamental shift in thinking about knowledge in the university: a shift from a view of content as "canned products" (Geser 2007, p. 44) with fixed boundaries, formats and timeframes, to one with open practices of knowledge creation that challenge the arrangements for university teaching, how it is located, what its boundaries are, and whether it should be protected and promoted as a reusable and adaptable resource.

Methodology

The activity and investigation into the potential for OER at La Trobe University can be traced to two sources: a working group self-organised around a one day conference on OER at the university in March 2013 (Open Education Working Group 2013a), and a report to the university's Planning and Resources Committee *Beyond 2017: Imagining the Future of Learning at La Trobe University: Report of the Radical Learning Project* (Macken et al. 2012). One of the report's recommendations was "The extension of learning beyond enterprise systems and the incorporation of OER, third party and cloud-based learning resources into subject design" (p.5). The working group published a response to this and other recommendations of the Radical Learning Project, in the publication *Discussion paper on open education* (Open Education Working Group 2013b). The discussion paper aimed to develop strategic aspirations into a case for OER and proposals for their implementation in the university. In summary, the discussion paper presented the case that OEP improved educational outcomes for the university, and to realise that improvement requires a better alignment of policy infrastructure and practices. The outcomes discussed in the paper included evidence that OEP improves access to high-quality content and results in greater retention of students and improved lifelong professional learning for staff, students and graduates. In terms of policy infrastructure and practices, the discussion paper made suggestions towards aligning teaching and learning, intellectual property policies, the technology systems and library repositories, and existing teaching and learning practices toward open education practice.

This paper is an outcome of the Open Education Working Group that brought together representatives from three faculties and two central units: the library's digital infrastructure unit, faculty educational design units, and the university-wide academic development unit. This multi-authored paper by the working group has itself brought together disparate parts of the university with the goal of articulating how the university can establish new connections between organisational parts and integrate arrangements for teaching and learning in order to embed OEP. In the following sections the authors consider, as practitioners representing distinct but interdependent standpoints, the significance and challenges of a disruptive shift from the traditional structures for teaching and learning to OEP. The following sections describe a series of perspectives within one university: a state of play on OER development nationally; issues arising for OEP in publishing teaching and learning resources; setting up an effective OER repository; and finally embedding OEP in educational design.

The OER landscape in Australia

Deliberation on OER has only recently emerged in Australia, and national conferences and forums on higher education have only relatively recently offered much discussion of OER and OEP. In Australia there has been an absence of national developments in OER, as for example, the cross-institutional disciplinary focus of the OER program in the UK (Higher Education Academy 2013), or Brazil's Scientific Electronic Library Online (SciELO) (Böhm 2013). Despite this, there have been recent initiatives around open education in Australian universities – five of these are described in Bossu et al. (2012). A national project, funded by the Office of Learning and Teaching, surveyed key stakeholders in the university sector concerning OER (Bossu et al. 2012). The study found significant challenges for the sector, which can be summarised as: issues relating to policies around intellectual property, a lack of knowledge and awareness in academic culture, and issues around quality, funding and "discoverability" of OER. A key challenge relates to the possibility of a coordinated and cross-institutional response in Australia, and how effective OER initiatives would be from within individual universities.

The recent upsurge in interest in Massive Open Online Courses (MOOCs) discussed in media commentary, both locally and internationally, has been followed by different and often contradictory understandings of open education, with notions of openness tending to slide into an understanding of access (Blackall 2013). These equivocal interpretations of "open" in education and resources were identified in the Horizon report (Johnson et al. 2013) and OLCOS Roadmap (Geser 2007). The Open Education Working Group, in their discussion paper, drew on these sources to distinguish "open", for example in some MOOCs where content is open but subject to conditions for use, and the inherent openness of OER:

> Open education does not simply refer to access to freely available content; it includes non-restrictive terms and conditions and transparent development processes. Open education practices use collaborative methods and frameworks to develop content, curriculum, assessment, research, policies, projects, budgets and so on.
> (Open Education Working Group 2013, p. 2).

This understanding of openness in the sense of open for further use is clarified by Johnson et al., "open education advocates are working towards a common vision that defines 'open' as free, copyable, remixable, and without any barriers to access or interaction" (2013, p. 7).

Openness has retained this unrestricted meaning in development outside the higher education sector, in areas of open government, open access research publication and open data. Three of these developments are:

1. In 2010 the Australian Gov2.0 Taskforce made their recommendations to the Department of Finance and Deregulation calling for a declaration of open government, resulting in a requirement for public service information to be accessibly published and carry freely reusable copyrights – specifically the Creative Commons Attribution license (Department of Finance and Deregulation 2010). At the same time the Australian Government's Open Access and Licensing Framework (AusGOAL) was established to provide support and guide government and related sectors in facilitating open access to publicly funded information (AusGOAL 2011). In New Zealand the Minister for Internal Affairs reported that 16 NZ Government departments will be compliant with their Declaration for Open and Transparent Government by 2013/14

(Tremain 2013).
2. Closely affiliated to the open government lobby is the open data movement, working to make publicly held collections of data and content openly accessible, and then demonstrating the usefulness of this by developing new content, software and graphic visualisations showcased in what are colloquially called datahacks and mashups. The Australian National Data Service (ANDS) is attempting to coordinate data repositories and data access and reuse. AusGOAL advises ANDS on this, and recommends clear licensing, standard formats, and accessibility (Australian National Data Service 2013).
3. The push towards open research and open publication of research has achieved recent breakthroughs, with the National Health and Medical Research Council (NHMRC) requiring accessible publishing of research as a condition of its funding (NHMRC 2012). The Australian Research Council followed suit in 2013 (Australian Research Council 2013).

These developments signal a shift in strategies for national digital infrastructure that supports open standards and practices. Universities are now confronted with the decision of whether to follow this shift and align their systems and practices for development of educational knowledge and content with these broader initiatives for open data, or maintain existing publishing arrangements that offer significant restrictions to access and cost to students and institutions.

Embedding OEP: Publishing and sharing OER

The introduction of OEP introduces tensions with existing institutional arrangements. The radical implications of embedding OEP in the institution, as indicated earlier by commentators such as Neary & Winn (2009) and OER visionary reports, carry potential conflicts with existing practices. One question concerns whether OEP is giving content away for free and conflicts with commercialisation opportunities for faculties or institutions. The following two vignettes highlight issues that arise for publishing open content. The first concerns access to resources.

Adopting OEP case study: Faculty of Business, Economics and Law (FBEL)

Core to the faculty's drive towards open education is the desire to increase higher education participation by reducing the barriers to education for students. The Federal Government's report on Australian higher education participation (Bradley et al. 2008) called for a range of measures to increase participation rates for "members of groups currently under-represented within the system, that is, those disadvantaged by the circumstances of their birth: Indigenous people, people with low socio-economic status, and those from regional and remote areas" (p. xi). The move to increase the proportion of students from low socioeconomic backgrounds highlights the significant cost barriers to education, including the additional costs such as textbooks. The proportion of students from low socioeconomic backgrounds at La Trobe accounts for approximately 18% of our undergraduate cohort (La Trobe University 2012), and thus issues of accessibility and affordability have serious implications for student success and completion rates.

To address these issues, the faculty introduced a strategy for incorporating OER into the first-year curriculum. An intensive curriculum redesign process for core units of study aimed to address some of the factors that contribute to student retention and completion rates (Riddle et al. forthcoming). The result was the introduction of a 4+2+2 program for first-year studies which included a set of core multidisciplinary units to be undertaken progressively by all students undertaking a Bachelor degree in the Business School. By undertaking these multidisciplinary units students are able to move more easily between programs without penalty. A consequence of introducing these multidisciplinary core units was that no pre-existing textbooks matched the curriculum, thus a door was opened for the potential deployment of OER to fulfil the role of traditional textbooks. What followed was the intersection of conflicting goals. The concept of OER was introduced to the curriculum design team as they were launching a tendering process with local publishers to provide customised textbooks in print and electronic formats for the new core units. Once the tendering process had begun, the door to OER was effectively closed, as the publishers provided a "solution" that was perceived to ease workload demands, whereas the OER approach was viewed as requiring additional work by staff. The additional demand on students to purchase or otherwise arrange access to the textbook (e.g. through the library) was viewed as an acceptable price to pay (arguably because such arrangements have been the traditional convention for many years in higher education). This experience exemplifies how an initiative to introduce OER can produce inconsistent institutional practices, in this case, with the standard "business as usual" operation of outsourcing educational resources such as textbooks. The consequence of the faculty's decision to prescribe textbooks – at a cost of up to AUD$270 for print and electronic access for one semester's worth of core units – is a failure to address one of the most basic issues affecting student retention and success. The study conducted by Riddle et al. (forthcoming) concludes that OER must be introduced strategically; from the very outset of the curriculum design process.

A widespread model of educational content provision for on-campus students is to outsource resources to commercial publishers, and request students (and libraries) to pay for those resources. The publisher in turn recoups their costs (and covers their profit margin) by charging students and libraries to access that content, via printed textbooks or electronic (online or offline) textbooks. The emergence of OER foregrounds the institutional acceptance in shifting the cost of this resource production and provision onto students and, ultimately, their own libraries, with potential downstream effects on students' access to resources and completion of courses. In order for policies that support OER to take effect, they need to connect with practices associated with curriculum resources in a course or program, and a strategy to align those practices.

Connecting OEP with commercial opportunities: The iTunes U approach

Since 2011, La Trobe University has been making educational content available free to the public via Apple's platform iTunes U. This content includes podcasts of lectures, videos of demonstrations and interviews and PDFs of slideshows and handouts. All of this content resides on the university servers and is available to users with and without Apple mobile devices. The Ancient Mediterranean Studies program at La Trobe was established in 2012, and adopted iTunes U to raise domestic and international awareness of the new program. Three subjects from the program have appeared as iTunes U courses since 2012: *Ancient Greece*, *Classical Mythology*, and *The Roman World*, which had more than 100,000 subscribers and 1.4 million downloads – a much larger number than can be accommodated through on-campus enrolments.

The interest generated by these iTunes U courses has transferred to other media and other forums. *The Australian* newspaper reported that a podcast lecture on the Emperor Nero, downloaded 160,000 times last year, was "a phenomenally successful foray into the world of free online courses" (Trounsen 2013). He notes, "that has put it among iTunes U's regular top 50 offerings alongside the likes of Yale and Harvard." Trounsen voices the competitive pressures for universities and the marketing opportunities with appealing content: "[i]t has given the university a world stage to market itself, though how to make any money out of the free online phenomenon remains elusive" (p.3). La Trobe's *The Roman World* course on iTunes U is now the subject of a pilot project investigating the commercial possibilities arising from providing educational content for free. The iTunes U course will run for a second time in 2013, again providing podcast lectures and PDFs of handouts and slides free of charge. Subscribers will also be offered the option to enrol for a fee, granting them access to La Trobe's learning management system (LMS) and library sites for additional learning activities and materials, interaction with subject experts, weekly asynchronous tutorials and online discussions, and assessment tasks and accreditation. The aim is that releasing high-quality content freely through a global platform such as iTunes U will raise awareness and attract fee-paying students looking for a greater level of engagement.

In addition to its function as a distribution platform for all rights reserved content, iTunes U can be used to distribute openly licensed content. Most of La Trobe's iTunes U offerings are currently licensed under a traditional all rights reserved copyright licence. This conservative approach has been a default position in the absence of a developed policy on OEP, though it should be noted that La Trobe's intellectual property policy states that:

> "The University encourages the authors of Teaching Materials to consider making such materials publicly and freely available, e.g., via the internet, or publishing commercially providing that those materials are not subject to a prior third party agreement…"
> (La Trobe University 2011, p. 2)

As OEP become common to the university, programs have the option of assigning a Creative Commons license for educational content in iTunes U. Allowing others to freely use, adapt and even sell the educational content has the potential to bring university-branded materials to the public eye, to the awareness academics and students elsewhere, and even into commercial textbooks. The economic value of providing OER is difficult to quantify, but it is interesting to consider the practice of releasing teaching materials as OER in relation to the marketing budget of a university such as La Trobe. Creating high-quality educational content is part of a university's core business, but new developments in education technology that enable further reach in the worldwide education market present a range of commercial opportunities.

Embedding OEP: Setting up an OER repository

An important part of La Trobe University Library's role is to manage scholarly information for the university. As part of this work, the library manages the Research Online digital repository and collects and provides open access to scholarly publications, educational resources, research data and other works. The digital repository is primarily designed as a data source for indexing content for dissemination outside of La Trobe University and for publicising and providing access to research and educational materials to the wider world. Libraries also have a recent history of providing research guides and other teaching materials (often covering information literacy, research skills, bibliographic management tools and relevant research materials) within external systems. The practice of providing open educational content is demonstrated in the use of LibGuides (a vendor product that is an openly available on the internet), and La Trobe has over 250 LibGuides authored by Library staff.

The involvement of the library in the Open Education Working Group began in 2012 after meetings between the Faculty of Health Sciences and the library regarding educational content (mainly videos) and the need to provide a storage and discovery mechanism for this content. The library at that time was very keen to extend the use of the digital repository for the deposit of learning objects/resources for discovery and reuse at the university. The extension of this philosophy to making this content open and providing access to unique La Trobe University authored works was supported by the library executive team in terms of creating a "Learning Object Repository", according to the library's operational plan for 2012.

This commitment to open content has been a mission of the repository managers and repositories in general in libraries since the Australian Research Repositories Online to the World (ARROW) and ANDS projects were set up, from 2005-2013. Despite the support for practices of extending existing resources into OER, the digital repository is still seen as an internal resource, rather than a repository for works available externally and discoverable via search engines from outside the library repository. This requires an institutional shift to OEP. There are still existing structures and practices that present barriers to openness in how a digital repository is perceived, promoted and therefore used by academics.

To shift the use of a digital repository to OEP, the library needs to provide the following support within the repository:

1. A searchable interface for OER, with tailored indexing and metadata fields which will enhance discoverability and searchability of OER items authored by La Trobe University academics.
2. Integration with the La Trobe University LMS (Moodle) in order to provide automatic connections to enable uploading of OER into the repository.
3. A tailored set of metadata fields using an appropriate schema such as the IEEE (Institute of Electrical and Electronics Engineers) Learning Object Metadata Schema (IEEE 2002), along with the correct markup to enable the Creative Commons licence and other copyright permissions to be indexed appropriately in Google and other search engines, to enhance external discovery of OER objects in the La Trobe University digital repository.
4. Development of plugins within browsers (for staff) or enhancements to the repository (with forms for uploading) to enable automatic dissemination of OER within open external systems such as Wikimedia Commons, Archive.org or more proprietary systems such as YouTube or iTunes U.
5. Development of dissemination scripts, RSS feeds, feeds of metadata using the open archives initiative protocol for metadata harvesting (OAI-PMH) or development of other scripts or software to provide automatic dissemination of La Trobe authored OER content to relevant external sites, as identified by the university.

Some of these items may require the provision of resources by the university for software development to achieve these objectives. The library's repository software is based on open source software practices using the Fedora open source repository software. The indexing, repository metadata management, and search interfaces used to manage the repository all deploy software managed by a commercial library system that supports the system management beyond that which the library is able to provide.

This provides an open software structure that can be used to produce further enhancements and developments which may benefit an OER repository infrastructure. One of the original reasons that the repository software was set up, using funding to support the ARROW initiative, was to support open source software within a national framework. Hence university repository software became able to produce a national repository of research publications within the National Library of Australia's Trove system. The university library within this context is keen to be able to support the development of a national infrastructure to enable the discovery of OER and other learning resources, possibly within the National Library of Australia. At a national level, in relation to learning resources designed for school education, there is the National Digital Learning Resources Network which is providing learning objects for schools through education portals. In a similar way, a national portal for educational resources for tertiary/university-level institutions, with feeds coming from individual sites, would be an effective way to share and make OER available at a national level.

The JISC report, *The roles of libraries and information professionals in Open Educational Resources (OER) initiatives* (Bueno-de-la-Fuente et al. 2012), supports that libraries can provide significant resources in the areas of:

> "description and classification, management, preservation, dissemination, and promotion of OER. In order to support these activities, librarians provided expertise in information science areas, especially: metadata standards, vocabularies, indexing and classification, information retrieval, information literacy, and repository technology and management."
> (p. 7)

Thus, it is clear that the library has a significant role to play in engaging in OEP in any educational institution. The quality of classification and metadata management contributes directly to the success (or otherwise) of any OER initiative (Andreatos & Katsoulis 2012, Wenk 2010).

Embedding OEP in educational design

From an educational designer perspective, practices to embed OER into curriculum often occur on the fly, as an individually led bottom-up process of incorporating the rudiments of OEP, for example, contributing to and using Wikimedia, YouTube, iTunes U, a local Free University, or using Creative Commons licensing. This practice is likely to occur in the absence of an institutional approach to OEP. Contributing factors for this "openish" activity include:

- pedagogical objectives not being met by university systems
- lack of faculty resources to engage other paid, proprietorial software and systems
- the desire to expose materials to a wider audience, primarily for reasons of marketing profile (both individual and institutional)
- ease of access to materials in the case of open internet resources
- providing a model of professional practice for students in the online environment.

The technological practices of learning environments in universities have been dominated by closed enterprise systems so that pedagogical development is focused on idiosyncratic and institution-centric environments, or what Beetham et al. (2010) have observed as "management of learning by digital means, rather than the exploration of disciplinary knowledge and knowledge practices in a new digital context" (p.1). There is a dissonance between students' everyday practices within digital environments through social media uses based on Web 2.0 platforms, and the academic practices valued in university teaching and assessment that takes effect as closed, short-term activities (Dohn 2009). This disconnect has implications for the way OEP can cultivate an innovative and dynamic curriculum that fosters deep and engaging learning experiences for our students. OEP offers an opportunity for students to develop skills that enable them to assert their academic identity in collaborative, creative and critical expression in an open – and by its open and digital nature – global, environment to foster lifelong learning and knowledge practices. OEP in this environment offers the opportunity for us to challenge organisational frameworks and "assessment regimes which remain largely locked in transmissive mode", and ask how they "can be recrafted for the open, collaborative spaces" (Hemmi et al. 2009, p. 29).

OEP has, therefore, the potential to operate as a strategy for systematic change in academic practice in curriculum renewal. Price & Oliver (2007) observed that "[a]s learning technologies are implemented and some form of eLearning is put into place, the practices that accompany them tend to 'become invisible'" (p. 24). OEP makes eLearning practices more explicit by adopting pedagogic innovation, for example, peer review of open assignments, or collaborative projects of open co-construction. OER, then, operates as set of adaptable examples. Two examples in practice follow.

1. Chinese 1001

The Chinese 1001 unit provides a good example of both unit delivery and OEP assessment. Resources or transmissible content is provided for Chinese students on a Google site which is a shared collaborative resource developed by a teaching academic and a colleague at an interstate university, together providing a portable and replicable digital resource. Open sharing of teaching resources on the internet is permissible, and indeed encouraged, by the La Trobe University intellectual property policy (La Trobe University 2011). This collaboration offers a way to share curriculum development effort, extend teaching and the development of teaching resources beyond institutional boundaries, enabling potential for quality improvement through peer review by staff. The Google site also offers students an immersive language interface not available with the current LMS.

This unit offers students a number of opportunities to collaborate "openly" on translation exercises through both in-class use of Google docs, and through the Marco Polo Project. The Marco Polo Project is a not-for-profit organisation that uses the possibilities of online collaboration to improve cultural and linguistic understanding between China and western countries. This website also serves as a collaborative translation platform, where students can practise their translation skills on authentic material and receive feedback on their translation from other, more advanced users, providing an opportunity for students to participate in global knowledge networks. This example highlights the importance of defining the resource aspect of OEP as practices – something you do, rather than something you access.

2. La Trobe Health Sciences on Wikiversity

La Trobe Health Sciences has been established as a category in Wikiversity, where the Faculty of Health Sciences is piloting the development of OER and OEP. In just six months, 59 projects were developed under this category, ranging from unit outlines and curriculum through to professional development project coordination. A pilot of OEP was approved by the faculty in November 2012, and the teaching and learning team has been encouraging the use of popular platforms such as the Wikimedia projects to implement that pilot.

The Wikimedia projects have been used as development spaces and have exposed staff to the considerations of open access and online transparency, leveraging the benefit of volunteers who educate and support the faculty in learning about OER and OEP. For example, text and media with restrictive copyrights cannot be copied into these project spaces, and a high level of diligence over copyright is maintained by those volunteers, who highlight the copyright limitations to faculty staff, and press them to rectify any copyright transgressions. Open standard formats are also being encouraged and supported by the same means.

It is anticipated that engagement with these platforms will create a range of resources and practices that will transfer into other spaces, both physical and online. For example, if a program of study is developed on Wikiversity with links to resources listed in Wikipedia, additional media on Wikimedia Commons, and a text on Wikibooks, these materials will be in the formats and needed and with appropriate open copyright licences for reuse in other websites that match the local context of the course, such as a course or unit website. Equally, the skills around information handling, collaborative workspaces and engaging popular reference projects may inspire changes in engagement practices, toward open participation generally.

Conclusion: First steps for OEP

The accounts in this paper reflect the *multiplicity* of educational practices that are open or in the process of becoming OEP. The task of embedding OEP in a university becomes matching this multiplicity to existing institutional arrangements, and to initiate change in the organisation and form shared goals. This paper, therefore, reflects the contingent and risky process of drawing together disparate parts of the university for the purpose of establishing OEP. To embed OER in practices, there are critical connections to be made across the university, at strategic and meso levels. The task of establishing such connections in a complex institutional environment suggests several points for consideration, informed by the practitioner accounts above:

- OEP can be supported through institutional intellectual property policies that align with broader open data initiatives (Australian Gov2.0 Taskforce, Australian National Data Service, NHMRC, ARC).
- University policies and procedures can support OEP without compromising the potential for commercialisation of educational resources. These can work in parallel, for example, offering a unit of study in multiple OER formats, and then bundling this content into iBook format for sale through Apple's iBookstore.

- Institutional digital repositories can extend beyond the model of traditional library catalogues to connect to open systems and enable dissemination of content as OER. Repositories can also be developed as federated; open and shareable with other institutional repositories.
- OER brings the potential for open publishing of both research outputs and teaching and learning resources through the same means in a repository, with the recognition through attribution and citation in both cases.
- An indicator of embedding OEP is the work of curriculum design: how readily can institutional OER be adapted for local projects, and to what extent are practices and resources able to be shared in the OER community?

There are attendant sensitivities about digital artefacts and resources threatening academic ownership of content, and others have noted the unsettling effects of digital knowledge and practice on academic identity and authority. Land points to the way that online interaction, characterised as Web 2.0 , often sits uncomfortably within existing higher education practice and "textual instability, according to Barnett (2005) comes to function as a reflection of instability in the university's idea of itself" (Land 2011, p. 63).

In this sense, defining "open" gives agency to participate in this change, while acknowledging and focusing on aspects of the digital which could give rise to exploitation. A institutional policy or strategy that provides a rationale and workable definition of OEP, allowing for variation in contexts, could encourage the practice, adoption, and production of open and sharable resources. The question remains as to how the "openish" activity mentioned above could be enhanced through institution strategy and an OER space.

To establish OEP requires an integrated institutional change process in which top-down, policy-level support meets situated and strategic exemplary projects. One direction is indicated in Neary & Winn's (2009) proposal to "refashion the university" and challenge the production of academic knowledge. In this scenario, teaching and learning content share the same practices as research output, through a process of open and public knowledge creation. The alternative is to accept the "business as usual" practices of publishers in higher education that offer significant restrictions to access and cost to students and institutions.

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Building bridges for non-engineers: virtual world support for project based delivery

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For the past decade, educators have participated in virtual world teaching. Manukau Institute of Technology entered the virtual world of Second Life in 2009. Since then foundation or bridging students have repeatedly demonstrated skill development and knowledge acquisition through the utilization of virtual world resources. A change in the way the foundation curriculum is delivered has taken place over the last two and a half years with a switch to project-based delivery. A Virtual World Club was started to support students in their project work. Over the past year, the club has attracted attention from students and lecturers that has led to a more widespread adoption of the use of virtual worlds. Plans are underway to bring MIT students into alternative worlds, and recent technical advances will be an integral part of the direction MIT will take in future years.

Keywords: virtual worlds, Second Life, foundation, bridging, enabling education, project-based delivery

Introduction

Manukau Institute of Technology (MIT) in South Auckland, New Zealand, entered the field of virtual world teaching in 2009. The entry point was with the Second Life Education New Zealand (SLENZ) foundation project (Hearns & Kelly, 2009). The value of virtual world teaching and training was shown in a significant improvement in real life interview assessments following training in the virtual world of Second Life (Hearns, 2012). In 2010, MIT School of Foundation Studies changed to a project-based system of curriculum delivery. The use of virtual worlds continued. A Virtual World Club commenced in Semester 2, 2012, to provide support for students in their class projects. The work done in the VWC has encouraged an increased use of virtual world resources.

This report will outline the past, present, and future use of virtual worlds for education, then examine foundation or bridging education and how virtual worlds can be used to support project-based delivery in a foundation studies or bridging programme. The activities and influence of the Virtual World Club will be examined together with a brief look into the future of virtual world education at MIT.

Virtual worlds – past, present and future

Virtual worlds are 3D environments that share common features: they are persistent, immersive, and scalable. A virtual world is populated with multiple simultaneous participants who are social beings and can communicate with each other through text or voice chat. Participants represent themselves as avatars in the virtual space. “Avatar” comes from the Sanskrit word for "a form of self" and is a computer user's self-representation or alter ego (Papp, 2010). Bartle (2004) characterized virtual worlds as “places where the imaginary meets the real” indicating the balance that designers try to achieve between reality and fantasy in the virtual environment. Virtual worlds have also been referred to as Multi User Virtual Environments (MUVEs) or Massively

Multiplayer Virtual Worlds (MMVWs).

For many years Second Life (SL), developed by Linden Labs and launched on June 23, 2003, was the main virtual world used by educators. The enthusiasm for the use of virtual worlds, and SL in particular, reached its peak from 2007 to 2009. By 2009, there were hundreds of leading universities and institutions around the world using Second Life as a part of their educational programs (Virtual Environments Enable New Models of Learning, 2009, para. 1). Following the decision of Linden Labs to abandon discounts for educators, there was a movement out of Second Life and into OpenSim and other alternative platforms.

The numbers of virtual worlds is still growing steadily, as the range in types of virtual worlds also increases. Recent trends indicate that accessibility to virtual worlds will accelerate in the future with technology such as sim-on-a-stick (Hax, 2012; 2013) web-based html5 with a canvas element that enables 3D (Hax, 2010; Paul, 2010), and virtual world mobile apps for smart phones and iPad (Taylor, 2011; Trier, 2013; ProtonMedia, 2013). Hundreds of publicly accessible virtual worlds exist (ArianeB, 2011) and companies such as Forterra Systems build many private worlds for businesses and the military. In a recent survey (Gregory et al., 2013), 32 Virtual Worlds Working Group (VWWG) educators from 18 Australian and New Zealand universities and technical institutes, reported that SL remains the most common virtual world in use (88%). However, only a few institutions (27%) rely on SL alone.

Foundation education and project-based delivery

Foundation education, also referred to as bridging or enabling education, is aimed at students who have a strong desire to pathway into tertiary education but do not have the prerequisite skills or knowledge. Middleton (2003) stated that the aim of foundation education is to enable students to achieve success in learning and success in life.

Manukau Institute of Technology (MIT) is situated in South Auckland and runs one of the largest foundation departments in New Zealand (over 500 students). MIT foundation students represent over 60 different countries of origin, with approximately 40% from the Pacific Islands, 20% indigenous Māori, 15% Indian, 15% NZ European and 10% from a variety of other areas (SMS Records, Semester 1, 2013). Many foundation students have a history of social, emotional, financial, and literacy problems. Some do not have English as their first language. Many faced failure and rejection at school as the traditional classroom setting did not suit their specific learning styles.

MIT foundation students have had exposure to Second Life since 2009. Foundation students were motivated and engaged in interviewing training in SL and achieved results that indicated the skills they learned were successfully transferred to a real life interview environment (Hearns, 2012). A cohort of Māori pre-degree nurses participated in literacy activities in Second Life, and showed improvements in writing and digital literacy (Hearns, 2011).

The positive results obtained by MIT foundation students in SL can be attributed in part to the relative safety felt in the virtual world environment and the increased motivation to participate that resulted from a sense of presence (Hearns, 2012). “We exist in physical reality. We live in physical reality and sometimes we “live” in virtual reality. Although our biological needs cannot be satisfied through virtual reality, our emotional needs can be” (McKinney, Shao & Shao, 2011, p. 161). Emotional closeness through shared experience and a sense of immediacy arises out of interaction in virtual worlds (Salt, Atkins & Blackall, 2008.) The sense of shared experience is particularly significant for foundation students and Māori and Pasifika students in particular.
The use of virtual worlds at MIT has continued despite a change in curriculum delivery. For over two years (2010-the present) the School of Foundation Studies at Manukau Institute of Technology has adopted a project-based method of curriculum delivery. Although focused on the production of an end project, the method could be labelled ‘theme-based’ as there are many components to each project, all centred on the same theme. Literacy, numeracy, and science are all embedded into project content.

Russ, Richardson, Lowther, and Taituha (2011) mentioned that a firm foundation for learning was provided by facilitating personal responsibility and actively engaging students in seeking meaning and understanding, and that was true regardless of students’ ethnic backgrounds. The current teaching methodology used by MIT’s School of Foundation Studies attempts to reflect the values of Māori and Pasifika cultures. This is done by being aware of the needs of Māori and Pasifika students; ensuring learning is engaging and relevant; and adopting a holistic approach that builds personal management and behavioural competencies as well as skill and concept mastery (Russ et al., 2011).

Preuss (2002) discussed the benefits of a project-based method of teaching. These benefits centre on connections. Students establish connections by working in groups or teams, sharing ideas, recognising the validity of the opinions and perspectives of others, accepting personal responsibility for learning, and taking pride in accomplishments. Howell and Mordid (2003) also mentioned the feeling of self-worth when students were able to see a concrete end project as the result of their learning journey. They stated, “When a student actually enjoys the process of learning, the learning takes care of itself. That's one of the benefits of the project approach” (p. 34).

The current MIT Foundation programme is focused on learning how to learn. Adult learners are encouraged to contribute their understanding based on life experience and this provides a richer learning climate for other students in the project groups. The sustainability of students’ learning is encouraged as students develop skills that are transferable. Sharma (2010) suggested that the “education of today might be obsolete tomorrow in a technologically driven social environment” (p. 103). She suggested that one of the approaches that will “prepare the learner for creative adaptability to address the challenges an evolving society may present in an imaginative future” (p. 103) is project-based delivery (together with practice-based, place-based, and industry-based learning). The aim of the new programme delivery at MIT Foundation Studies is to equip students with the skills they will need to be prepared for a journey of learning, following their career pathways and beyond. Wright and Overton (2012) stated that an affiliated goal of this delivery shift has been to develop students’ technological awareness.

To assist students in their projects and to help them develop their technological literacy, a Virtual Worlds Club was initiated at MIT, starting in Semester 2, 2012. Last semester the club ran only one day a week after class on a Tuesday. In Semester 1, 2013, the club ran after class on a Monday, and during the lunch hour every Thursday. In Semester 2, 2013, the club is scheduled to continue as per Semester 1. Attendance at club sessions is completely voluntary. The activities for the week support the work in class.

The Virtual World Club has increased enthusiasm for the use of virtual worlds from both students and other staff. As a direct result of the work done in the VWC, there has been an increase in the use of virtual worlds for project support in normal class time.

The Virtual World Club (VWC) and beyond

In Level 2 Foundation Studies all cohorts run the same projects. At Level 3, projects differ from cohort to cohort (the cohorts for 2002 were Health, Social Sciences, Business, and Engineering; and in 2013 Business was combined with Social Sciences). In Semester 2, 2012, the students who attended the VWC were from both Levels 2 and 3 of the foundation programme. As it was difficult to cater for the needs of the different levels who were engaged in different projects, VWC sessions were split into Levels, and alternate sessions run for Level 2 and Level 3. The only attenders from Level 3 were from the Health cohort (pre-degree nurses). In Semester 1, 2013, all participants were from Level 3 Health.

The following table illustrates some of the projects at Level 2 and Level 3, and a sample of the VWC activities that took place.

Level 2 Projects	SL Activities		Level 3 Health Projects	SL Activities
Our Journey - focusing on the students as individuals & their study pathways	Personalising my avatar -how can I show who I really am?		A future in healthcare -biological me plus health care providers	Health Information Island -worksheet & meet the professionals
Cult Couture -designing a garment from recyclable or natural material	Fashion design in SL -creating an outfit from full perm clothing for a competition		Infection -understanding infection & its control	Genome Island -investigating cells, including viral cells & bacteria
MITe Chef -creating a healthy snack	Ohio University Nutrition Game		Nutrition & Mobility -what we need & what happens when things go wrong?	Virtual Ability Island & wheelchair house, Danish Visions sim
Water -why do we need water?	Centre for Water Studies -guest lecturer Jack Buxbaum, followed by a trip to the CWS sim		Holistic Wellbeing -an ideal treatment environment for a health condition	Te Wāhi Whānau -an ideal birthing unit

Figure 1: Selection of projects & activities in SL

Figure 2: VWC students on Virtual Ability Island (left) & in the Danish Visions wheelchair house

The Virtual World Club has increased enthusiasm for the use of virtual worlds from both students and other staff. As a direct result of the work done in the VWC, there has been an increase in the use of virtual worlds for project support in normal class time. Several health classes have participated in information-gathering interviews in the holistic wellbeing project; the pre-degree engineering cohort have entered SL to visit the Areva Nuclear Power Plant, the Ellinogermaniki agogi virtual portal to see the Virtual Atlas Project and to the Etopia EcoCommunity; and, as from Semester 2, 2013, all Level 4 BioScience students will participate in research on Genome Island.

The Virtual World Club (VWC) Student Feedback

Although 20 students actively participated in the VWC, only four students in Semester 2, 2012 and three students in Semester 1, 2013 were regular attenders. These students were asked to reflect on the experience of attending the club and whether they had benefitted in terms of the work they were doing on their projects. Students completed a Blackboard Survey which consisted of eight Likert scale questions, phrased both positively and negatively (the scale consisted of Strongly Agree, Agree, Partially Agree, Partially Disagree, Disagree, and Strongly Disagree). The data was automatically summarised by Blackboard and student comments remained anonymous.

Figure 4: Health students preparing for their interviews (left) & engineering students touring the Areva NuclearPower Plant

Students were unanimous in agreeing (or strongly agreeing) that activities in SL were a positive experience, that they had learned new skills in SL, and that the knowledge they gained in SL helped them complete their projects. They were also unanimous in disagreeing that the time spent in SL was a waste of time, and that they could not apply their skills to their project work (with one partially disagreeing). Students were not quite as positive about it being easy to do research in SL, with three only partially agreeing. When asked if they felt they were really present in the SL environment, six strongly agreed and one partially agreed. Two students partially agreed with the statement that they did not feel connected to their avatars, three partially disagreed, one disagreed and one strongly disagreed. It is interesting to note that the students who did not feel connected to their avatars did not attend the session where students personalized their avatars.

Students were asked to record the best thing about their SL experience. A common thread was that it was interesting, colourful, fun, and "better than the textbook" (Student 3). One student specifically mentioned the cell exploration on Genome Island, and one mentioned the ability to solve problems in a real setting. Student 14 had this comment to make, "I highly recommend using SL for whatever subject a student may be studying towards. Awesome idea and love the concept of it."

Students were asked about the things they did not like. The majority dealt with technical issues of lagging and crashing, although these proved to be only minor problems.

The last question dealt with suggested improvements. Four students suggested more time and the opportunity to take students from the same cohorts or pods as a group into SL. A suggestion was also made to provide "activity cards" so that students could meet out of class and VWC time, and get together with their classmates and friends when they had time to spare.

Conclusion

Students engaged in the VWC, were enthusiastic about their activities, challenges and trips, and the feedback they gave suggested the club was a worthwhile addition and support to their project work. In the words of one club participant, "We should have the club in class, not in our own time. It's fun in SL. I like working and having fun at the same time" (Student 5). The use of SL at MIT in the past was effective and produced excellent results. It is currently engaging students and enhancing their project work. In the next semester, the VWC will continue and more classes will be entering virtual worlds. Apart from the Level 3 health classes using SL for information gathering interviews, students will be meeting disabled residents of Virtual Ability Island in the mobility project. A literacy game, currently being built on Kitely, will be tested with two classes of the pre-degree nursing cohort.

Virtual world use has accelerated at MIT and students have benefitted from the addition of learning activities in virtual worlds. At least within the near future, MIT will continue to use existing resources and develop new activities to challenge and motivate students to enjoy their learning journeys.

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"The slides are part of the cake": PowerPoint, software literacy and tertiary education

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This paper reports on the findings from a two-year funded research project exploring software literacy - how it is understood, developed and applied in tertiary teaching-learning contexts and how this understanding serves new learning. MS PowerPoint was selected as an initial focus as it is widely available and commonly used. Two disciplines (Media Studies and Engineering) were case studied and data collection obtained through student interviews and an online survey. Findings revealed that students tend to draw from informal learning strategies when learning to use PowerPoint, they have the functional skills and understanding of the software, and were able to identify some of its key affordances and constraints. However, they were only able to critique these at a superficial level, suggesting a need for formal recognition of software literacy as a means to empower students to engage with software and its use at a more critical level.

Keywords: software, literacy, teaching and learning, PowerPoint, university, New Zealand

Introduction

This paper reports on the initial findings from a two-year (2013-2014) Teaching and Learning Research Initiative funded project exploring how tertiary students develop the understandings and skills needed to use software as forms of *software literacy*. Three strands of thinking dominated and shaped our conceptualisation of this project - the software studies paradigm, our revision of notions of digital natives and digital literacy, and recognition of student engagement in a range of informal (and some formal) learning contexts when learning to use software.

Software studies, a comparatively new field of enquiry that Manovich and others have championed (Fuller, 2008; Johnson, 1997; Manovich, 2008), insists that 'software', which encompasses many forms of computer programming, is the dominant cultural technology of our time, fundamentally shaping the nature of our institutions, and integral to many of the social, political and economic practices central to our everyday lives. A core premise of software studies is the need to move away from seeing software applications as neutral tools – "simply things that you do something with" (Fuller, 2003, p. 16). The argument is that there is a need for software users to develop a more critical awareness of how software operates to both 'empower and discipline' us (Kitchin & Dodge, 2011, p. 10-11), contextualising and framing our agency within the embedded logics and affordances of software applications. We propose there is a need for detailed empirical research into how software is understood, interpreted, and ‘performed’ by individuals and groups within a tertiary education context. How do both lecturers and students engage with software applications, platforms and infrastructures? How do people learn and perform different kinds of software, and what are the implications of this for their teaching and learning practices? For the purposes of pursuing this interest we introduce and define the notion of software literacy, as the expertise involved in selecting, using and critiquing software applications where these are being used to achieve particular goals.

Our notion of software literacy is a practice-based schema which anticipates that users can scaffold from acquiring a basic use of an application, to appreciating its configuration and limitations, and then perhaps to developing an awareness of how software operates to shape and frame knowledge and knowledge generation, communication and use within disciplinary practices. We view software literacy, then, as encompassing three specific levels of capabilities:

a. a basic functional skill level, enabling the use of a particular application in order to complete a specific set of tasks;
b. an ability to independently problem solve issues faced when using an application for familiar tasks (which includes the ability to draw upon various resources to help solve difficulties); and, ultimately,
c. the ability to critique the application, including being able to apply a similar analysis to a range of software designed for similar purposes - enabling the informed selection of applications and more ‘empowered’ new software learning.

In these terms, the most ‘critically literate’ users both develop the ability to identify the affordances of particular software tools and are able to apply and extend their knowledge and use of these and other software tools to a range of new and different purposes and contexts. Users may acquire software literacies through a combination of any number of means; through trial and error, learning informally, or training in a more formal or structured way. Most people develop proficiency with ubiquitous software packages informally through everyday engagement. Tertiary students are assumed to be able to translate these knowledge and skills into formal settings to complete learning tasks.

Labels such as ‘digital natives’ claim to describe the characteristics of a new generation of learners, capable of operating at ‘twitch speed’ and able to multitask, imagine, and visualize while communicating in multiple modalities (Prensky, 2001). This term tends to conflate a basic skill with new technologies with broader forms of understanding and critiquing aspects of technology-based cultures. We need to unpack this set of assumptions, to more carefully identify the range of skills and other literacies that today’s students do (and do not) bring to their tertiary learning. There is emerging evidence that although this generation may be technologically competent, many still lack the basic academic technological literacy skills needed to successfully apply software embedded technologies effectively to enhance their learning (Kvavik, 2005). We argue that that there is a need to revisit and revise concepts such as information literacy, digital literacy, and related terms (Hegarty et al., 2010; Livingstone et al., 2013). In particular, we need to differentiate between distinct literacies relevant to specific technologies, and to examine the nature of student critique and decision making around which tools might best serve their learning purposes.

A crucial question here is whether, in an environment of universal access to digital tools, the ‘digital divide’ is being reconfigured as inequalities in software literacies. Recent research indicates that inequalities and marginalisation persist around students’ access to, and use of information and knowledge (Bennett, Maton, & Kervin, 2008). Digital inequality is not restricted to just the issue of physical access to software and hardware (Selwyn & Facer, 2007), and given the various forms of investment required in the adoption of ICTs in the tertiary sector, it is imperative to understand how to close the participatory gap for students and ensure that technology is equitably and effectively used (Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006). No studies to date that we know of raise the role of student understanding of how software and its affordances influences knowledge generation and critique, or the influence of formal and informal learning in relation to software.

Research Context

In this paper, we report on the initial findings from a study conducted earlier this year (March to June) exploring how students develop the understandings and skills needed to use particular pieces of software in a tertiary institution in New Zealand. Two very diverse disciplines of study, engineering and media studies, are being case studied. PowerPoint (PPT) is commonly available and used; we assume that students, irrespective of their backgrounds, have had some experience with it. Both cases begin with a focus on PPT (in Phase 1) and will move (in Phase 2) to focus on the teaching and learning of discipline specific software such as Adobe Photoshop, Final Cut Pro (Media Studies), and SolidWorks (Engineering). The focus of our paper is on the initial Phase 1 findings aimed at understanding how students in first year undergraduate courses become aware of and develop software literacy understandings and skills about PPT. Both courses are characterised by high enrolments of students (180 and 104 students respectively) with diverse backgrounds but differ in terms of disciplinary foci and professional pathways. Data was collected through an online student survey (179 respondents) and student focus groups (36 participants). Analysis of the data was underpinned by sociocultural theory which directed attention to the interaction between people, the tools they use to achieve particular purposes and the settings in which the interactions occur (Cole & Engestrom, 1993). Emergent themes were identified through a process of inductive reasoning (Braun & Clarke, 2006).

Findings

Four themes emerged from investigating students' perspectives about PPT: 1) their general comfort level in engaging with technology and how they acquired the skills to use PPT; 2) PPT's affordances and constraints; 3) the extent they refer to their PPT notes for their studies, and how they extend their understanding of the notes; and, 4) how they think PPT shapes knowledge in their discipline.

1. Student comfort level with technologies
When asked about their general views towards adopting technologies, 42.1% of students indicated they usually use new technologies when most of their friends do, 30.2% reported liking new technologies and using them before most people they know do, and another 16.4% indicated they love new technologies and are among the early adopters to use them. These results illustrate a majority of students (88.7%) consider themselves early or quite early adopters of new technologies and are comfortable in engaging with new technologies.

Students drew mostly from informal learning resources when acquiring basic skills to use PPT (i.e. the first level from our software literacy scheme). When asked to identify 'useful', 'very useful' and 'extremely useful' strategies for learning, trial-and-error emerged as the preferred option (86.9%), followed by asking an expert (86.8%), asking a friend (84.9%) or watching someone use the application (82.1%). These stand in comparison to attending a formally organised workshop to learn about PowerPoint (42.3%), or reading a paper manual (33.1%). Common across the main reported strategies, then, is the idea that students take the initiative and agency to go about learning about PPT.

2. PPT's affordances and constraints for presenters and audience
When asked their views on the *opportunities* that PPT affords for presenters, students indicated the application allowed the embedding of multimedia resources in a presentation (88.4%), in-built templates helped to structure and organise ideas (85.5%), and affirmed how easily information can be incorporated into slides (81%). From an audience perspective, students highlighted that PPT affords audience paying attention to key points in a presentation through its default bullet points (87.2%), and guided note taking (82.8%) and the provision of more focused lecture presentations (77.5%). Focus group interviewees added ideas such as: PPT bullet points provide a reference point which can be expanded on; slides are visually easy to follow and save writing time; multimedia resources within slides can be an appealing and meaningful prompt for learning; presentations are easily customizable; and finally that all material is self-contained within a PPT file making it easy to access and revisit. Our participants identified the main three *constraints* of PPT to be: the brevity of information on each slide (67.6%), PPT files not containing enough detail for students to understand a lecture (65.2%), and a tendency for presenters to move too quickly through presentations (63.2%). The focus group data also highlighted frustrations with PPT layout or templates used in a repetitive manner; PPT used as a 'fixed script' for a lecture; text-laden slides presented too quickly for their content to be processed; and visuals that are inappropriately used in the PPT slides.

3. Student use of PPT notes for revision and strategies for extending their notes
A majority of students reported using PPT notes in revising for their course (76.8%) while another 56% of these students reported doing extra study to add to their PPT notes to better understand the lecture content (either through making their own notes (60.9%), attending the lecture lab or tutorials (60.5%), or reading the course textbook (59.6%)).

4. How PPT shapes knowledge

Although very few students discussed how PPT shaped their disciplinary knowledge, four focus group participants alluded to this by explaining how learning through PPT lecture notes is akin to learning via factoids and the decomposing of information. These are encapsulated in the following representative quotes:

> Student 1 : In PowerPoint, you see a lot of factoids put on the screen rather than actual information. One of the things I noticed the other students were saying that they liked the bullet points. Society as a whole seemed to be heading towards factoid based learning rather than actual learning.
>
> Interviewer: How do you think a lecturer kind of scripts or builds a PowerPoint presentation?
> Student 2: Just the key points. Parts of a cake. The slides are part of a cake.
> Interviewer: So is it important to capture everything that's there on all the slides?
> Student 2: Yeah
> Student 3: Well, yeah because I try to break it down into main points and you can't really miss anything.

These discussions conveyed a common student (mis)assumption that the PowerPoint bullet points in and of their own adequately reflected the extent of the knowledge presented in a lecture. For some students, these meant not much work was needed to extend them further.

Discussion and Conclusion

Our study aimed to understand the extent to which and how first year tertiary students are critically aware of how specific software can impact their learning, with PPT as a case to understand the emergence of software literacy. Our participants were generally comfortable with engaging with new technologies, identifying themselves as early to quite early adopters of technologies (89%). They reported a range of learning strategies that were mostly informal when acquiring the skills to use PPT, particularly the use of trial and error. Both these findings support assumptions in the 'digital natives' label. Further, students could successfully identify the affordances and constraints of PPT use, and quickly applied these to observations and criticisms of their (and other) lecturers' PPT presentation practice. Our participants generally considered PPT to be central in their engagement with disciplinary knowledge, particularly enabling the embedding of multimedia resources, focusing and structuring/organising lectures and guiding note taking. However, outside of the occasional focus group response such as in the first quote above, student critique of how this application might *shape* their disciplinary knowledge was surprisingly superficial (In our terms, there was a clear absence of the third level of software literacy).

These findings have two implications for tertiary teaching and learning. Firstly, teaching and learning of courses involving a focus on software can be informed by and take advantage of students' informal repertoire of learning strategies. As an example, students can benefit from being given time for practice and trialling a software for themselves. Being informed by and drawing from students' already established informal learning strategies recognises the relevant social and cultural contexts that shape effective technology and software engagement and if appropriated accordingly can enhance technology-based pedagogies in the tertiary sector. Next, students superficial critique of PPT revealed that critical awareness does not necessarily develop naturally as a result of use of a software, rather it needs to be prompted and/ or explicitly taught. Lecturers need to explicitly model software critique if they wish to foster this capacity and/or make this possibility known to students. Scholars such as Vallance and Towndrow (2007) urge educators to adopt an *informed use* approach to using PPT, that is, lecturers consider how they talk around PPT slides and how they encourage students to engage with and think about the content of the slides influences students' interpretations and engagement with disciplinary knowledge. Similarly, Stoner (2007) highlights the logics inherent to default PowerPoint templates, while O'Dwyer (2008) emphasises the need for careful thought and reflection in the design of (Engineering) PowerPoint presentations in learning settings.

The next phase of our study will consider the above issues more specifically in the context of courses where software teaching and learning is a main and discipline rather than learning based foci. This phase addresses two core aspects of the pedagogy around software: how to teach software, and, how to teach *about* software. In relation to the first aspect, we would like to provide teachers with an empirically-informed guide to best practice in teaching disciplinary-specific software (such as SolidWorks or Final Cut Pro). While the second aspect would involve repositioning PowerPoint as one of a range of common applications that shape learning, and which need critical awareness on their use by *both* teachers and students. For students, having this critical awareness would mean a recognition of the role of how software in a broader sense shapes their learning experiences, and in a more specific sense then see the need to take on more active learning strategies in pursuit of learning goals.

In concluding, we view understandings of how software literacy develops and impacts on teaching and learning can lead to insights into the cultural significance of software more generally, and especially lecturer and student understanding and use of the practices associated with knowledge generation, communication, critique in engineering and media studies. Software literacy, in other words, is an essential part of learning in the twenty-first century, one which we argue transcends the use of any particular tool (be it within the context of e-learning, mobile learning, or software-based practices yet to come). This understanding is crucial and relevant to ensure all students and lecturers are better supported in teaching and learning processes that are mediated through and focused on software.

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Arguing again for e-exams in high stakes examinations

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This paper presents the argument that e-exams are needed and long overdue for use in high stakes examinations in the tertiary sector. Evidence is drawn from the educational and higher education literature to establish that the environment is ripe for the adoption of e-exams. A set of requirements for a suitable approach to exams is established that takes into consideration the needs of students, the pedagogical concerns of academics, while being sustainable and scalable. An outline of the features such a system will need in order to meet these requirements is discussed, along with a program to implement and trial such a system at a large university.

Keywords: computer based assessment, high stakes assessment, examinations, e-exams, e-assessment

The need and readiness for an e-exam solution in the higher education sector

Currently the use of ICT for teaching and learning, and in particular the current use of paper for high stakes exams within most higher education institutions lags behind the extensive usage of ICT by students in their study (Riddle, 2008; Riddle & Howell, 2008) and everyday lives. This is evidenced by the increasing use of ICT for a range of daily tasks (ACMA, 2012), with a recent survey of students at a large Australian university during 2012 indicated 98% ownership of mobile WiFi enabled devices with laptop ownership the highest at 91% (McManus, 2012). Surveys conducted in the United States reveal similarly high ownership rates (Dahlstrom, 2012; Williams, Drechsel & Kokil, 2012; UWM, 2012; UAA, 2011; McCue, 2012). The Australian survey also shows 80% of students accessing the online learning management system at least weekly. This provides evidence that students already have a familiarity with the technologies that can be used for e-exams; while the small minority who do not own suitable equipment can be addressed with a loan or equity program.

It is strongly evident in missions, strategic plans and graduate attributes that institutions in the Australian higher education sector are firmly committed to improving the teaching and learning environment in order to allow their students to be successful in their studies and graduate with the knowledge and skill sets needed in the modern world. These are expressed in teaching and learning plans in the areas of enhancing e-learning and blended learning that many Australian higher education institutions already have in place (for example UQ, 2012b). Further, an internal university survey of senior teaching leaders placed ‘e-assessment / online marking’ (UQ, 2012a) at the top of their priority list for development. So it could be argued that e-exams are the next step on from the increasing use of e-assessment and computer assisted marking for progressive assessment.

There is likely to be understandable apprehension on the part of academics and management when it comes to adopting new, fully electronic processes for high stakes exams in place of familiar paper based processes. This is a barrier that needs to be addressed by demonstrating secure and reliable digital systems and procedures and by offering a graduated transition pathway from pen to keyboard. On a national policy level information and communication tools are seen by the Australian federal government as holding great potential for realising as yet unfulfilled potential in higher education as it has done in other sectors of the economy (Gillard 2008). Therefore it is argued that there is a strong need to develop and successfully implement suitable e-exams systems and procedures and that these will be a key enabler in fulfilling the vision and strategies at national and institutional levels.

We argue that without a suitable, computer based way of conducting exams, then such positive transformation across the education sector is less likely to occur, particularly since the form of assessment is a key factor influencing teaching and learning behaviour (Ainley & Searle, 2005). The experience in Tasmania (Fluck, 2007, 2011) has been that once the University started offering e-exams, this acted as a catalyst for the secondary school system to follow suit. Prior to this, the secondary school system was reluctant to make the move given they saw part of their role as 'training' their students to be successful in University examinations.

Increasing student numbers, spurred on by national participation targets, are placing pressure on physical facilities. For example the University of Queensland (UQ), saw an increase of 30,000 exam sittings 2007-2012 (UQ 2012c). UQ with its high proportion of on-campus students is already facing a shortage of suitable venues to hold traditional exams. A similar increase in numbers is occurring across the higher education sector while budgets are increasingly constrained. We argue that e-exams offer a possible way to expand capacity; however the strategy adopted is critical in ensuring the implementation is sustainable and scalable. While existing computer teaching lab spaces can provide some short-term relief to space shortages, these are limited in capacity and do not provide ideal layouts for exam conditions (Dermo, 2012). Custom built spaces designed for e-assessment are not commonly available in most institutions and when constructed are expensive and quickly reach capacity limits (ibid). The use of online exams with students sitting off campus, at home, provides a potential solution to looming space shortages, however it also raises concerns of potential exam protocol breaches when students are not under direct supervision in a controlled environment. Thus on-campus invigilated exams remain the preferred option for high stakes testing in higher education and it is this scenario that is the main focus of this paper.
In consideration of the above societal needs and trends, along with a review of the e-assessment literature, a set of drivers and requirements for the development of a suitable e-exams system are suggested (a mapping of each requirement covered below to proposed system functionally is presented later in this paper). It should be noted that the use of 'system' is meant more broadly than just the technology components and includes elements such as people, processes and policy. The requirements and drivers are presented from multiple perspectives including a student's view, a pedagogical or teaching view, and an institutional view.

Requirements and drivers towards a suitable e-exams system

The following requirements, drivers and surrounding arguments we have identified as likely to be of concern for various stakeholders.

Students

[R1] Students rarely hand write assessment responses anymore– they normally type. Course delivery in the tertiary sector is moving increasingly online where most items of work undertaken by students for non-supervised assessments such as reports, essays and quizzes, are typed (Mogey et al, 2010). The typed medium is also the dominant form of written communication with email and text messages. This means that students are now more familiar and comfortable with typed input than the handwritten form (Frand, 2000) particularly when it comes to assessment. Furthermore this increased computer use has been shown to reduce handwriting motor skills (Sülzenbrück, 2011) leading to discomfort in long hand written exams. Complaints from students about exams hurting their hands have appeared in the media (Ratcliffe, 2012). All of this leads to a growing disconnect between the way high stakes testing is conducted using pen on paper exams and students' everyday experiences (Fluck, 2004; Cowling, 2012; Dermo, 2009).

[R2] Students are familiar with computer based input methods and the devices they own. Just as a student can choose their 'best pens' to bring to a written exam they could be allowed to use their own familiar, comfortable keyboard and mouse. It is argued that this would mean that in high pressure situations they will be more efficient and less stressed (but not stress free) than otherwise because they don't need to worry about using unfamiliar equipment. Previous familiarity with computer use has been shown to increase student choice of keyboards over pens (Fluck & Mogey, 2013).

[R3] Students now have high ownership of laptops with surveys at Australian universities showing that student ownership of laptops is up from 60% in 2007 (Oliver & Goerke, 2007) to around 90% today (Deakin, 2012; McManus, 2012). Utilising this ready resource of student owned devices to serve as the necessary hardware for running exams would assist with minimising the costs associated with institution owned equipment.

[R4] Student owned devices are diverse (UQ, 2013a). These devices come with numerous operating system versions and software applications across even the three most common types of Microsoft Windows, Apple

Macintosh OS X and Linux (NetMarketShare, 2012). This would, if used in their supplied state, result in an inconsistent software environment between candidates; making use of these devices fraught with complexity.
[R5] Students do not like their personal equipment and software to be interfered or privacy breached by exam authorities or others. Students have a lot invested in their equipment in-terms of cost, time, personal ownership and privacy. The equipment is often important to their ongoing studies and personal lives so safe guarding its integrity is an important consideration with ethical, moral and possibly legal implications. Most e-exam solutions in the marketplace that make use of student owned equipment are intrusive, often installing and leaving behind software components that interfere with the operation of the computer. Some use biometrics while others use tools such as 'key loggers' to track candidate activities which raise concerns for privacy (Levy et al, 2011).

Teaching and Pedagogical
[R6] Technology enhances the range of assessment scenarios and question types when compared to paper based approaches (Crisp, 2010). The ability to incorporate multimedia elements including video, virtual views, scenarios, software tools, simulations, are all made possible with computer based forms of assessment. The Transforming Assessment website by Crisp & Hillier (2012) provides extensive examples of computer based questions. Traditional paper based exams provide little opportunity for feedback and has been described as a 'feedback desert' by Scoles, Huxham and McArthur (2013). Computer marked questions have the potential to provide instant feedback, or at least, faster processing of results. If matched with electronic marking tools and workflows faster feedback could also apply to essay questions, although with the latter longer return times would apply.
[R7] There is a need to provide all students with an equivalent environment for reasons of fairness while catering to equity issues (Mogey, Sarab, Haywood, van Heyningen, Dewhurst, Hounsell, & Neilson, 2007). Various exam authorities utilise different definitions of fairness (Fluck, 2012; Bouville, 2008) that range from providing the same environment to all candidates to providing different environments to ensure accessibility to those with disabilities. The exam system should have a range of accessibility features available to all.
R8 There is a need to provide orientation to students in regard to the exam environment. The use of paper based exams in the past were conducted when students commonly used pen and paper in assessment tasks and where the use of mock and practice exams prior to high stakes events meant that students could easily be accustomed to the medium prior to entering the exam room. The introduction of electronic exams will also require that practice sessions and exposure to the medium of the exam will need to be carried out. Students should be prepared in a way that places them in a good position to concentrate on demonstrating their knowledge of the topic rather than the medium and mechanics of production.

Institutional
[R9] Sustainable provision of computer hardware and facilities will need to be achieved. It is unlikely to be sustainable or economic for institutions to provide each student with hardware for large infrequent assessment events such as exams. The cost of providing a large number of computers for each exam candidate for short periods each year makes this logistically difficult and costly. The construction of large enough dedicated exam facilities would represent a significant investment in physical infrastructure that may not be well utilised outside of exam periods. The hiring or construction of a temporary facility and provision of computers would represent a high re-occurring cost. Given the already high ownership of suitable equipment by students a way to make use of this equipment would be desirable. Software licence fees for proprietary solutions also add to the cost impost. The approach to financing ongoing technical and procedural support is also a matter for consideration.
[R10] Each institution has different technical infrastructure that makes it difficult to provide solutions that are applicable across the higher education sector, especially those that are easily integrated into existing software and hardware environments. Most technical solutions offered by commercial providers are platform dependant or are intrusive to privately owned equipment (JISC, 2010 pp.30-49; Chesney & Ginty, 2007). There is a need to develop an open and modular exam platform that would be inter-operable with existing infrastructure.
[R11] There is a need to provide a robust and reliable solution. Exams at universities are of the highest stakes. The process needs to be at least equivalent to paper based solutions in terms of reliability and validity to be accepted by stakeholders (university administrators, academics, students, parents, employers, governments and the public). Without a secure and reliable solution academics in particular will be reluctant to adopt e-exams. If things were to go wrong with the exam process, the university would risk loss of reputation as to their status as guardians of standards and as reliable accreditors of graduate achievements. The impact on students affected would also be significant with increased distress at a time of already high stress.
In developing an exams solution consideration will need to be made regarding the stability and security of computer hardware, networks, software, and the physical environment in regard to both controlled elements such as institution owned networks and uncontrolled elements such as student owned mobile communication devices. Similarly during the course of the exam invigilators should be able to easily identify that each candidate

is using authorised software.
[R12] Unauthorised data and communication must be excluded from the exam environment. A controlled software environment that provides the ability to prevent students accessing unauthorised resources such as web sites, mobile devices and communications, other candidates, 3rd party helpers outside of the exam room or the hard disk drive of the computer. Network or wireless access would need to be prohibited or access permitted only to specific locations containing the exam questions and resources or to channels that allow secure transfer of answers. Due consideration of the principles of information security (Whitman & Mattord, 2010) can guide developers in the early stages of system planning to help ensure a secure and reliable platform.
[R13] There is a need to provide efficient workflows for set-up, conduct and post-processing of exams. Universities already expend significant amounts of money and resources in running examinations and we do not want to unduly add to this impost. Therefore we should aim for the introduction of e-exams to be at least cost neutral over the longer term. To assist with efficiency the exam platform should easily accommodate automatically marked questions to be used when pedagogically appropriate and to minimise manual processes associated with setting-up exam scripts, running exam events, retrieval, processing and marking of student answers.

The above provides a framework for choosing a suitable e-exams solution.

Current e-exam solutions

An environmental scan of available e-exams solutions provided by commercial and other providers shows that the majority do not address the full range of the concerns above.
Existing solutions include one or more of:

- Built in quiz tools within a Learning Management System (LMS) such as Blackboard, Moodle or Sakai. In the main these LMS are not designed to be e-exams environments and this usually means students have access to other tools within the LMS. Their use for exams therefore requires close invigilation and currently requires the use of computer labs on campus; which leads to the next point.
- Tests and exams undertaken in fixed computer teaching labs on campus. Such spaces are normally limited to 20 or so students in a room, the number of labs is finite and layouts of these rooms is often not suitable for high stakes exams.
- Proprietary testing software applications. The majority of these are dependent on the use of a particular operating system with very few being cross platform. This means that the previous point again comes into play if institution owned equipment needs to be supplied upon which to run it. Further, many also install invasive components into computers.
- Outsourced testing centres or services, where control is passed to other organisations/individuals. Such services are mainly intended for small numbers or external/distance education students and tend to be costly on a per student basis. Further, the scheduling of exams occurs within a narrow range of dates meaning it is unlikely to be viable to use such services for the majority of students.
- Online proctoring services used by distance education students who are off-campus at the time of the exam. Being off-campus raises risks of exam protocol breaches in uncontrolled environments. Solutions also usually involve intrusive software being installed into student owned computers in an attempt to secure the inherently insecure environment of a student controlled operating system.

Judging from the current market place there is a need to develop a new solution to e-exams. However, rather than entirely re-inviting a solution from scratch it would be more efficient to draw upon existing ideas, processes or software. To do so would mean using existing software in new ways or making changes to such software. The closed source, proprietary software licensing regime of the current providers makes doing so difficult. The open source movement potentially holds a solution to the problem and fortunately such a suitable base is found in the already successful 'eExam' system being used at University of Tasmania (UTAS) and in pre-tertiary exams (TQA, 2012; Fluck, 2012). The solution utilises the highly customisable open source Linux operating system and allows students to bring their own laptop to the exam room. This overcomes two large hurdles when it comes to developing an enhanced e-exams solution, that of scalability and the availability of the technical components for change.

The features of the UTAS approach align with many of the requirements outlined above. Such features include being open and highly configurable, which means it is available for customisation and sharing of innovation in that there is an absence of concerns over commercial licence compliance (which also removes some costs). Further the system is cross platform and extremely light touch on student owned equipment.
However the system as it stands also does not meet all of the requirements and therefore needs further work to

improve its capabilities (a greater number of question types) and efficiency (computerised marking and greater automation of current manual set-up and response reticulation processes).

We argue that the strong need for a strategic, scalable and sustainable e-exams solution that meet the needs of tertiary intuitions and students can be brought about by improving upon available open technology components. To begin this process, we propose a set of design features and strategies as displayed in the following section.

Design for a suitable e-exams system

A design for implementing the above requirements is inevitably going to be multifaceted including a mixture of technology and procedures. To this end we have compiled a set of desirable functionality and strategies which have been aligned with the requirements discussed in the first half of this paper.
These are displayed in Table 1 while the complex interplay of these factors and subsequent features are displayed graphically in the concept map presented in Appendix 1.

Table 1: Matching functional strategies and requirements

Functionality or Strategy	Requirements
The approach should utilise student owned equipment. Students should bring their own devices (BYOD). This will be in the form of a laptop along with any additional hardware such as separate keyboard, trackpad or mouse.	R1, R2, R3, R9, R10
Enable the provision of an equivalent and controlled environment therefore addressing potential unfairness of disparate computer systems in any one exam.	R4, R7
The e-exam software environment should accommodate reasonable adjustments to cater for equity of access in terms of usability and accessibility resources. This should include features such as text size change, colour contrast adjustment, subtitles on video, transcriptions of audio tracks and to ensure the software environment can be used with alternative input devices.	R4, R7
The e-exam software should work on the vast majority of laptop hardware available in recent years. The ability to function on any Intel based laptops that can run MS Windows, Mac OSX and Linux will cover the vast majority of cases.	R4
Provide access to a loan or equity program for students who do not have suitable hardware and provision of spare computers and power sockets for students with older equipment needs to be part of contingency planning for e-exam events.	R3, R7
Student owned equipment should be completely returned to its prior state after the exam event, leaving no trace. E.g. by restarting the computer after the exam. Therefore the system architecture must maintain a separation of the student owned portion of the platform from the exam authority controlled portion without the latter interfering with the former.	R5
It should be capable of a range of question types including computer marked question types. These include question types typically available in modern learning management systems such as Moodle and Blackboard.	R6, R13
It should be capable of sophisticated constructed answer questions that take full advantage of the capabilities of computerised platforms. Including specialist or discipline based software tools such as simulators, calculators, multimedia scenarios will allow students to build, experiment and produce answers within the exam context. For example students could run a simulated chemistry experiment and submit results or progress through a multi stage scenario with multiple decision points submitted for assessment.	R6
Ensure students have prior exposure of the features of the software environment and the processes needed to undertake a live exam. This can be done through provision of supervised pre-exam test run sessions and mock exams to assist students to adjust. A copy of the software environment and trial exam could also be made available to students so testing of processes and candidate hardware can occur at home.	R4, R8
User documents and guides should be provided for students, academics and administrators.	R8
Ensure appropriate transition strategies from paper to electronic. For example, a phase in period where paper and electronic exams are run side-by-side with students having a choice.	R8
Allow institutions to choose the components and options that best suit their needs. Using a modular architecture and open source software for all components (e.g. for test creation, student software environment, question engine, backend post-processing) will allow institutions to put together custom configurations.	R10, R13

Institutions should be able to leverage existing software and systems as they see fit. E.g. use the e-exam software environment but linked to an isolated copy of their own LMS.	R9, R10
The exam authority should be able to gain complete knowledge of the software environment. Using the open source Linux operating system allows this to happen to a greater extent than closed source alternatives.	R11, R12
The configuration of the software environment should be controllable by the exam authority This includes having high level of control over candidate access to hardware features and data sources during the exam. Options include preventing local hard disk access, excluding one or more network interfaces, restricting network access to a given destination e.g. LMS or exam server, using restricted rights student account so that students will not be able to access any configuration services e.g. root, sudo, system files. Again, Linux is highly configurable which makes it a good candidate for security hardening.	R11, R12
Exam invigilators should be able to easily check if candidates are using the authorised version of the software. Special colour schemes and images can be chosen by the examiner to be used for desktop images along with custom logos and sequence numbers printed on USB sticks will facilitate quick visual inspection by invigilators.	R11, R12
It should be possible to restricted network or internet access to specified destinations. This will facilitate specific access to chosen websites or to allow transfer of student answers using specified network protocols/ports to institutional servers.	R11, R12, E13
It should be possible to establish secure and isolated wireless networks. For example, to run in-room server(s) and wireless access points as an isolated network in places where wireless infrastructure is unavailable.	R9, R10
Is should be scalable to large numbers of students. The BYOD approach means the number of computers required by students will scale exactly according to need. Given computers will be provided by the students themselves it is anticipated whole process will scale in a similar way to paper based exams.	R9
It should be cost effective. The costs of using UTAS 'eExam' system has been found to be lower than that compared to commercial solutions. The BYOD aspect of the approach means equipment costs are greatly reduced compared to scenarios involving institution supplied equipment. The use of readily available open source software and commodity hardware meaning only minimal support is needed to keep the platform up-to-date. The ability to freely share the platform across the higher education sector should also enable economies of scale in terms of future development. Given the lack of proprietary or commercial licences fees the costs associated with tracking and auditing usage is eliminated.	R3, R9, R13

In practical terms the features and strategies will take a physical and procedural form. A representation of how a suitable e-exam platform solution would work is depicted in Figure 1.

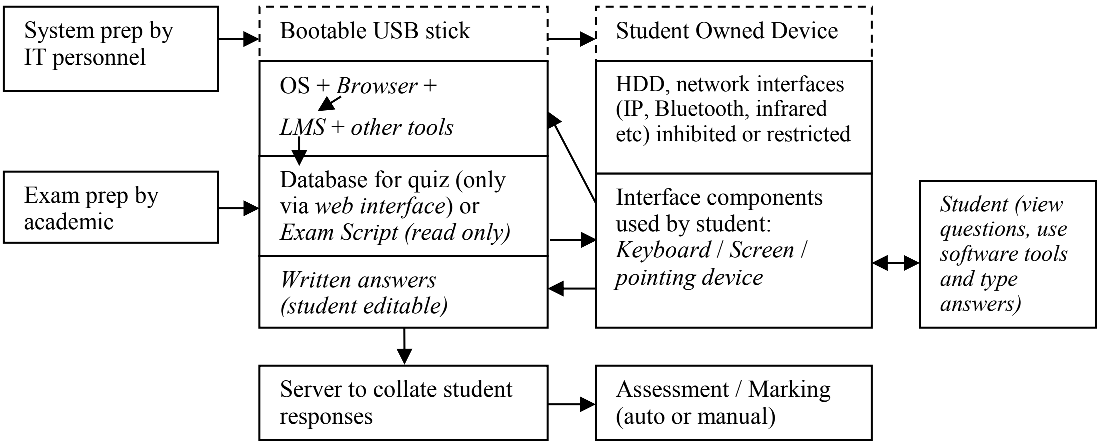

Figure 1: components of the e-exam system

The solution illustrated in Figure 1 can be further explained with an example use case. A typical process used to prepare and run an e-exam using the system is as follows:

1. A re-usable base USB model is prepared by institutional IT services in the form of a 'Bootable USB stick' data image. This would contain appropriate network configuration and access rules matched to the institutional context. Having a reusable base set-up means that the majority of the work in preparing the exam student platform only needs to be done once for each location in which it is to be used or upon software updates (e.g.

once a year per exam mode – 'open book', 'closed book' etc) rather than for each individual exam paper. Decisions as to the actual configuration would be made by the institution depending upon the nature of their infrastructure, i.e. availability of reliable wireless, use of institutional LMS, rules in place for conduct of examinations etc.

2. The base model and a dummy exam along with user guides would be made available to students. This is to allow them to practice the process of undertaking an e-exam and to allow them to gain familiarity with the e-exam software environment.
3. Each exam script (which may contain a combination of computer marked quiz questions and human marked questions) and a unique photo or image (to be used as a desktop background to facilitate invigilator identification of unauthorised or incorrect e-exam software) are prepared by the examining academic.
4. The exam script and chosen security image are placed on to a copy of the USB base model and then duplicated onto USB sticks by support services - one USB stick per candidate, using commercially available mass duplicators.
5. In the exam room the student boots their own laptop using the USB stick. The USB stick takes control of the hardware thus defining what the student can and cannot do during the exam (e.g. prohibit access to the hard disk, data ports, Bluetooth etc, restricting or prohibiting network access).
6. The student logs into the software environment using a generic restricted rights account to do the exam.
    a. In quiz based exams/sections, the student reads the exam questions in the LMS/question engine via a web browser. The student can only respond to questions via the browser interface as they would if they were using regular online quizzes in an online LMS. Quiz answers are progressively saved into the database by the LMS/question engine as the student progresses. For security, the database files are not directly readable or writable by the student account or the web browser itself.
    b. In paper-replacement essay exams a question paper set as 'read only' in the form of a word processing document of PDF. This 'essay' format is the fall-back in cases where computer marked questions are not appropriate or cannot be used. Essay responses are put onto an answer partition on the USB stick by saving a text document.
7. Student responses (quiz or written) are transferred to a server for collation. The method used depends on the style of the exam and the available infrastructure (see 'variations' below).
8. Quiz questions are marked by the LMS and results forwarded to examiners or the LMS gradebook.
9. Written student responses are forwarded onto examiners or markers for manual assessment and then entered into grade book. Manual marking is naturally the fall-back position. Although beyond the scope of this paper, it is worth noting that a range of electronic tools are available to assist human markers assess written student work if a fully electronic workflow is still desired (see TEDI 2013).

Some variation is possible and desirable. The pedagogical needs of the exam and the available technical infrastructure at the institution should be catered for by the platform. It is anticipated that an open, modular architecture will allow variations according to institutional need. Paper-replacement exams in the form of typed essay or short answer style exams, which are essentially electronic versions of traditional hand written exam script books, would be the fall-back position for this system.

In locations without internet access or where higher levels of security are required, isolated ad hoc local networks using portable servers and an array of wireless access points can be deployed in the exam room especially for the exam. The investment in a limited number of these machines would be sustainable (shared across many candidates and reusable) and maintainable in comparison to the hundreds or thousands of machines that would be needed if an institution were to supply computers for each candidate.

Inclusion of computer-marked question types would bring the power of modern quiz engines to the exam room and can be enabled either via an LMS on-board the USB stick or via a web browser interface to an LMS on a network server accessed over a restricted network connection. Within this capability three possible scenarios are foreseen that vary according to available infrastructure:

- Wireless always on mode – can be used where reliable, redundant and high capacity wireless network access exists in the exam room. This doesn't require an LMS on-board the USB stick. A web browser can be used to access a LMS server via restricted network access (access to other IP's / protocols / ports etc can be prohibited). A custom network configuration is set-up by each institution's IT services. This is done once to create a base model per institution/location which is re-used for each course/exam paper.
- Ad-hoc wireless mode – In this mode an LMS will be on-board the USB stick itself. Periodically a connection is made to upload/update student answers on a collation server. This may occur in the background using a 'drop-box' style folder or via a student initiated submission with confirmation shown on screen.
- Non wireless mode –Again an LMS will be placed on-board the USB stick. This approach requires duplicating equipment to reverse copy student answer files/databases from the USB sicks to a collation location. Where such equipment is not available a manual processes of copying each student's answer file would be the fall-back.

Proposed Research

The research program will take on the characteristics of interpretative (Greene 1994) action research (Galliers, 1991) in information systems in that it will be implementing changes in a, 'messy' (Ackoff, 1999), 'wicked' (Churchman 1967), real world educational environment and taking into consideration the multiple perspectives or view points of stakeholders (Mason and Mitroff 1981). The project will be based at a large research intensive University over a period July 2013 to June 2014. The research program will investigate multiple aspects relevant to running successful e-exams including technical, pedagogical, process, policy and people factors. The anticipated benefits and matching tangible outcomes are displayed in Table 2.
Data collection will entail two rounds of pilots utilising the new custom made software for assessment in active courses along with surveys, interviews and focus groups with stakeholders including students and academics. University educators involved in offering exams at the host university and at least one other institution will be invited to participate in interviews, which will aim to capture staff perceptions of the issues faced by academics in preparing and offering exams. An attempt will be made to purposively recruit participants from a range of discipline areas including Science, Education, Engineering, Languages, Pharmacy, and Veterinary Science in order to gauge different perspectives on these issues. Similarly students will be asked to trial the software system and asked to complete a pre-test and post-test survey. Student participants will also be invited to a focus group aimed at capturing what strategies they use to prepare for exams and their impressions of current and proposed formats of exams both paper based and electronic. The focus group data will be analysed and used in conjunction with a review of the literature to inform the development of the prototype and a set of draft guidelines for educators. The purpose of the guidelines will be to: raise awareness on the part of educators as to the issues faced by students when preparing and undertaking e-exams; offer concrete strategies for effectively preparing these students for the e-exams; and identify potential institutional and disciplinary challenges and strategies for implementing e-exams. The prototype and draft guidelines will be piloted along with the software at the host university in two rounds which will allow the iterative testing and refinement of the exam platform and related procedures in a real world application. Ethics approval will be sought via the host university's ethics committee drawing upon lessons learnt from prior studies done by Fluck (2004; 2013) to ensure equity for students involved. The program will be evaluated via the pre-test and post-test survey used to collect data, which will elicit perceptions from students on their experience of preparing and undertaking an e-exam, the effectiveness of the prep session and guides. Data will be collected from educators about the processes, procedures and the impact on their workflow and workload by the use of e-exams as well as on the draft practice guides. In the final stages of the project the set of good practice guidelines for preparing students as well as running e-exams will be drawn up.

Table 2: Anticipated research outcomes and tangible outputs

Outcomes	Tangible Outputs
To model an e-exam platform to be used in supervised, BYOD settings that includes options for computer marked questions.	A working prototype of an exams platform and documentation allowing others to reproduce it (see Design Specification).
Increased awareness by educators of the diversity of question types possible with e-exams.	A set of example questions that can be used in e-exams.
Increased awareness of quality processes and procedures for running e-exams.	A research-informed set of good practice guidelines on e-exam processes and procedures.
Increased awareness by educators of how they can better prepare students for e-exams.	A guide on preparing students for e-exams.
A collection of data to develop a further project application that will implement and evaluate a fully robust e-exams platform which will involve implementation in multiple institutions.	A project report and related publications that will include a summary of the data collected and findings.

Conclusion

The argument presented in this paper is that given the range of environmental conditions, drivers and requirements that exist there is a strong need develop an e-exams solution for the Australian higher education sector. Further, that such an effort needs to include the development of a multifaceted systems solution covering not just technology in the form of software and hardware elements but also the associated good practice guidelines covering, policy, process and procedures. These deliberations have so far give rise to three main questions that will drive further research. These are:
(1) How can e-exams be developed that are scalable, sustainable and valid across different contexts?

(2) How can educators prepare and run e-exams?
(3) How can educators prepare students adequately for e-exams?
To launch the research program we have presented a preliminary set of design specifications and the associated processes to illustrate how a suitable e-exam platform might be used in practice. It is anticipated that the findings from further research will result in the development and refinement of a robust e-exams implementation as well as a body of evidence to demonstrate the use of the system across a range of discipline areas and institutions.

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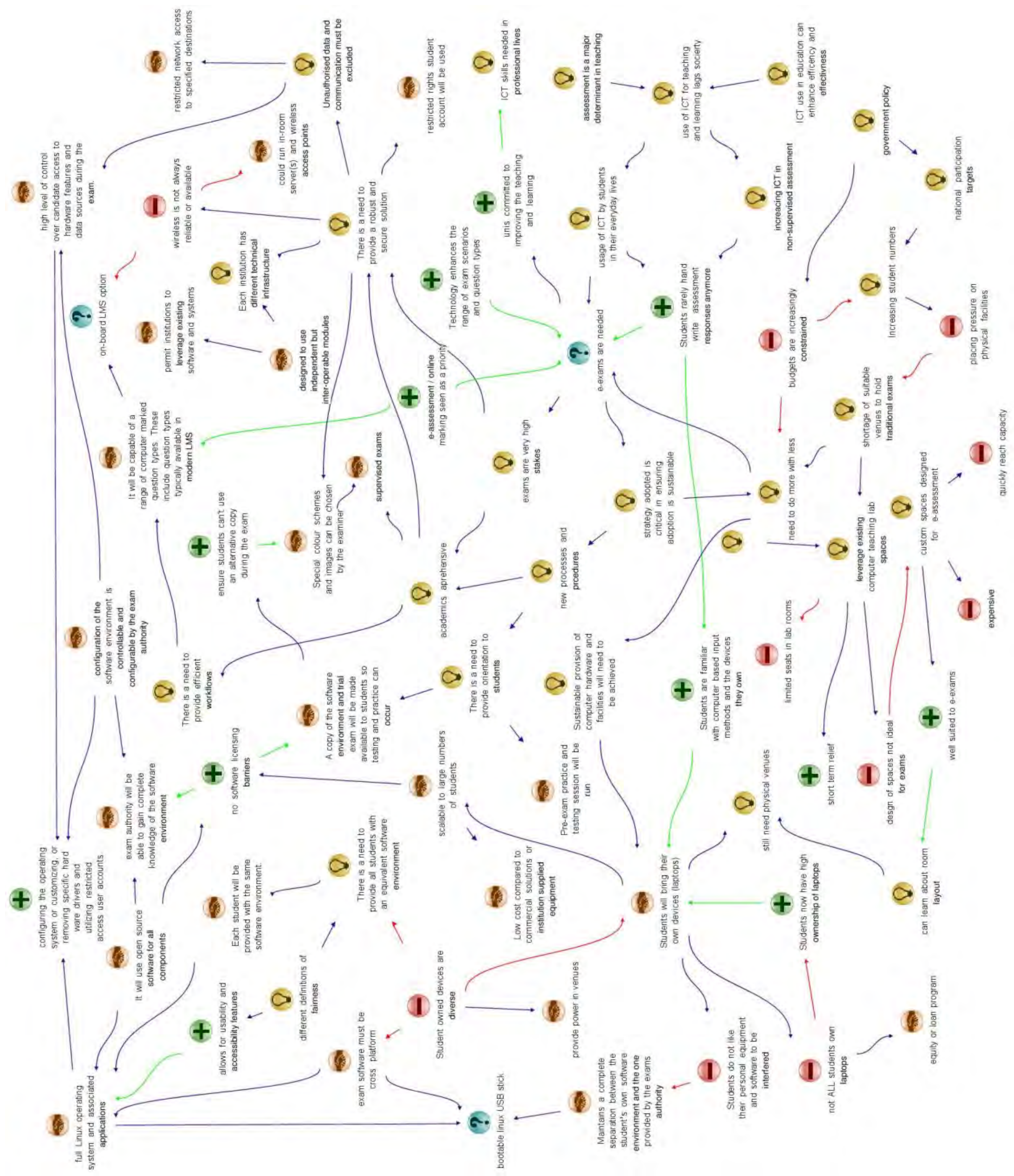
Appendix 1 – Concept map of the components of an e-exam system



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Design and development of examples to support authentic professional learning: a participative process

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This paper presents the results of a second phase of an evaluation of a set of example units (online teaching spaces). These were developed using a participative design process during a University's transition to a new Learning Management System. The first phase considered how the products were consumed as learning objects, and raised questions as to whether further work on example units was worthwhile; this second phase considers the impact of the process of development itself. Using a Developmental Evaluation approach, the paper analyses the reflections of a sample of participating academics and educational design and development staff, captured in semi-structured interviews. Both groups' experiences indicate that the process of creating the example units netted significant benefits for their own professional learning and that of their colleagues, as well as for the wider change management program. The implications of these findings for institutional practices and future research are outlined.

Keywords: Professional learning, new technology, online design, authentic learning, evaluation, LMS

Introduction

The introduction of new technologies in the higher education sector can be viewed as an opportunity to transform learning and teaching practice (McNeill, Arthur, Breyer, Huber, & Parker, 2012). Often, as an approach to managing such changes and introducing new technology to existing processes, change agents are used. The role of change agent is normally assumed by educational designers, developers and early adopters. Early adopters are one of five adopter categories linked to the bell curve of distribution of innovativeness (Rogers, 1995). Whilst early adopters have different characteristics, motivations, and needs to the mainstream, they can act as a conduit for the uptake of new technologies since "Faculty prefer to learn about changes and innovation from people they know and to which they have immediate access" (Jacobsen, 1998, p.6). Ensuring these change agents are able to use and promote the affordances of a new technology requires capability building through professional learning. Such professional learning activities include workshops, online resources, and one-one support.

The use of example units as learning objects is another approach to adopting educational technology that has been shown to be effective (Huber & An, 2012; Taylor, 2003; Wells, 2007). Learning can be situated in many contexts, such as social (Lave & Wenger, 1991) or experiential (Kolb, 1984). However if learning is to be transformative, it must involve critical inquiry (Webster-Wright, 2009). Embedding professional learning in an authentic workplace context and encouraging critical reflection will do just this.

Whilst example units have been shown to be useful in professional learning, what of their design and development? Are there benefits to be gained by participating in this process and if so, how should this activity be implemented? Kember (1998) advocates for an action research approach to educational development, highlighting that there is more stress on the process and "The act of participation is itself an outcome, so the journey becomes as important as the destination, if not more so" (p59). Kember (1998) goes on to explain that such an action research approach to staff professional development is not, as may first be thought a dichotomy in terms (collaborative and iterative vs. external direction setting). In fact, by engaging the participants in critical discourse, a collaborative approach can enable change to practice and result in high quality, curriculum design in a sustainable way.

While the terms "professional development" and "professional learning" both lead to advancing knowledge and are often used interchangeably, professional learning has come to designate a more active, engaging and transformative process (Groundwater-Smith & Mockler, 2009; Webster-Wright, 2009). We will henceforth refer to professional learning.

Background

The transition to a new learning management system (LMS) at one Australian Metropolitan university offered the opportunity for institution-wide enhancement of the online and blended learning environment. Underpinned by the overall aims of the University's Academic Plan of developing physical and virtual environments to provide a quality learning experience, a large scale project was established. The project's overarching aims were to foster and support the transformation of curriculum rather than simply moving content across from one learning management system to another, as well as capability–building, ensuring sustainability by supporting academics to learn how to design and build their own units.

One of the strategies put into place to facilitate these aims was the development of a set of example units that demonstrated features relevant for specific contexts. Example units enable the showcasing of technology within an authentic setting, thereby enabling teachers to draw links to their own classrooms and teaching (Taylor, 2003; Wells, 2007). A set of thirty four example units (one per teaching department) were developed by a team of educational designers and developers (who, in the interest of brevity, will be referred to as "Developers") in collaboration with academics who had been identified as early adopters. These example units were then showcased in presentations to departments and faculties, as well as being available online for use as self-help resources. Each unit was accompanied online by a short video of the academic explaining what was being showcased in the unit and why particular design decisions had been made. It was important that academics could see he new system in use in a unit, and in some way relate it to their own units and context. Early adopters and champions were encouraged to share their experiences, both positive and negative, to encourage peer learning (Huber & An, 2012). The majority of academics chosen or volunteering for this exercise had no prior experience of using Moodle (the new LMS). The educational design and development staff were in a similar position and in addition some were new to the university, having been employed in a drive to build support frameworks to facilitate the adoption of the new system.

In the initial planning stage for this project, the learning objects were titled "exemplars". The word exemplar is "a model or pattern to be copied or imitated" (Delbridge and Bernard, 1982, p.424) and often indicates exemplary or best-practice. As development on the units began, it became apparent that these units were not necessarily models exemplifying best-practice, but rather a range of examples of how the new LMS could be used. The units were then renamed "example" units or "showcase" units.

Methodology

As in the first phase of this study, pragmatism is the theoretical paradigm which underpins the research. Pragmatism provides the opportunity to use multiple methods of data collection and is oriented towards "what works" and practice (Datta, 1997; Owen, 2006). Reflective inquiry is utilized as part of the research protocol. Also known as "critical inquiry", Adler (1993) describes such an approach as "questioning, deciding, analysing and considering alternatives within an ethical, political framework" (p.161).

Method

The research adopted a multi-phased mixed methods approach; with a convergent design (Cresswell and Plano-Clarke, 2011) in phase one and a qualitative design in phase two. Phase one involved the analysis of LMS transactional logs and the collection of online survey responses to find out how example units were used as part of teacher professional learning and sought ways their design could be improved for better reuse in the next iteration. Twenty-five staff who had accessed the example units completed the survey, amounting to a response rate of around 9%. Phase one analysed the two strands of data concurrently and converged the findings in the analysis. Further details of this phase have been reported previously (Huber & An, 2012).

A cyclical design framework known as developmental evaluation (Patton, 1994) was used, in which findings are used to inform the development of the next research cycle. In this way, a second qualitative phase to the study was designed. This paper reports on this second phase whereby a group of Unit Convenors and Developers involved in the design and development of the example units were invited to be interviewed about their involvement and outcomes from working on the example units. Thirty individuals were approached by email, and eight agreed to be interviewed. Participants included three Developers and five Unit Convenors. Most of the participants were female, and most had little prior experience of Moodle. The Unit Convenor group included a participant from each of four faculties and two of the three Developers were new to the Institution.

In phase two, the semi-structured interviews comprised of eight questions that sought insights from two separate stages of the project: experiences during the process of development of the example units and experiences during delivery of teaching units, specifically around the impacts on professional learning. The interviews were recorded using a digital recorder and transcribed. Interview notes were also used in the manual analysis and respondents were grouped according to their role. The results/interview data were manually categorised into the two stages and themes were extracted. Each of the researchers did this individually and then their themes were compared, contrasted and discussed. In addition, Leximancer (a software package which uses statistical processing to automatically code text) was used to analyse the interview data and create two-dimensional concept maps. Using Leximancer as an analysis tool adds reliability to the data, since accuracy is the strongest form of reliability (Weber, 1990). It also introduces validity. Qualitative analysis in general can engender the concern that, since the researcher chooses coding concepts, they may tend towards making inferences. There may also be researcher bias and possible errors in their conclusions. Leximancer offers unbiased results from which to draw conclusions or at minimum to be used as a comparison (benchmark) of the researcher's findings. Finally the literature was "enfolded" into the themes to interpret, explain and substantiate their status (Eisenhardt, 1989), providing a theoretical underpinning to the analysis.

Research Questions/Outcomes

One of the main findings in the first phase of this study was the low number of staff indicating that they would revisit the example units. This indicated that staff may have gleaned the information they thought necessary on the first visit and felt no need to return. The question was posed as to whether further work on example units was worthwhile. The research team designed phase two of the study to delve further into the usefulness of the example units for teacher professional learning. In order to do this, the following research questions were used to underpin phase two of the study:

1. What were the benefits and challenges of participating in the example units design and development process?
2. How did the example units work once translated into 'real' units in an actual teaching context?
3. What impact did the experience of creating an example unit, and of accessing others, have on the participants' professional learning?

Results

The qualitative data collected in phase two of this study is reported here first using selective comments to highlight answers to the research questions and then as a summary of the automatic coding from Leximancer. The two data sets are then woven together in the discussion.

Design and Development Phase

Questions about the Design and Development phase inquired about the benefits and challenges of being involved in the project, and gave participants the opportunity to reflect on the impact of their involvement on their own professional learning.

Unit Convenors

Unit Convenors were largely very positive about their experiences of the design and development process. They tended to identify pragmatic benefits they enjoyed from participating, such as the level of individualised design and development support they received, and the fact that active participation ("getting your hands dirty" and being able to "learn as you go" (Unit Convenor 4), had "forced" them to organise their thoughts and plan the design of their online units earlier than they might have otherwise - "being on the front of the wave or front of the curve, as opposed to having to catch up" (Unit Convenor 4). These factors were identified as major motivations for Unit Convenors for initially becoming involved in the example units process, something they felt was then borne out by their subsequent experiences of the project.

The intensive design and development support for building the example units was perceived as extending Unit Convenors' confidence and abilities beyond what they might have achieved on their own, and giving them a platform from which to then build up their own capability using the new LMS, beyond the "basics". They were cognisant of the fact that while the example unit process had not been a comprehensive training program in using all aspects of the system, it had given them a "leg up" (Unit Convenor 3). Unit Convenors also saw the example units process as an opportunity to try out some aspects of the system before they tried it "for real", perhaps with a larger number of students. This was echoed by one Developer, who felt the Unit Convenors who participated are "pretty self-sufficient now, they're pretty confident that they'll be able to create similar looking units with those ideas in their heads by themselves now....I think the long-term benefit is really quite considerable." (Developer 3).

Some Unit Convenors emphasised that the process had impacted on developing their approach to learning and teaching generally, and not just on their skills for using the LMS. One Unit Convenor is planning to apply for an internal learning and teaching grant to further explore the potential of one of the tools used in her example unit.

Unit Convenors also identified benefits of the process for colleagues in their departments and faculties. While recognising that they themselves tended to be located at the "early adopter" end of the spectrum, Unit Convenors felt that there were benefits for all categories on the bell-curve, and that their experiences with "going first" with the example units had "percolated out" in a positive way to colleagues in their departments. They recognised that they acted as "champions" for the new LMS within their departments and were willing to play this role, to the extent of answering their colleagues' questions and acting to some extent in an LMS-support role: "You've got to make sure that these skills are developed within the departments as well, not just outside the department" (Unit Convenor 4). To a greater or lesser extent, the example units of all participants were seen as acting as an "ice-breaker" for other academics who had not experienced the new LMS and were perhaps reluctant or hostile about the change process. This effect was seen to be enhanced by the example units being authentic learning objects, situated in their actual Department context: "people respond much better to somebody in the department showing them what they've done." (Unit 1)

Unit Convenors tended to identify technical problems and their experiences using individual tools which had not gone according to plan amongst the major challenges of the example units development process.

Developers

Developers also saw themselves as benefiting from the process significantly in terms of professional learning. Again, the benefits were seen as going well beyond technical skills in using Moodle. Developers tended to place value on what the development process had afforded them in terms of relationship-building and orientation to an often new faculty environment, working in a team environment and sharing experiences, and exposure to a variety of units, learning objectives and teaching contexts through the project. The challenge of the competency required in needing to be able to present Unit Convenors with a recommendation or a range of tools for them to choose from in the new LMS was also considered a benefit. Developers also felt that the chance to work individually and intensively with convenors was of benefit to both Unit Convenors and Developers:

> I've learned a lot from the convenors as well, because it's really important I believe to listen closely to what they say, and sometimes just work that a little bit, and...add your own expertise and make that happen. Rather than sort of having a shiny, glitzy, glamorous idea, with all the bells and whistles, but then that doesn't necessarily work on the ground. (Developer 3)

Developers identified the level of engagement of the Unit Convenors and their willingness to be involved in a participative design process as a critical success factor in the development of example units, and often creating challenges.

> I had some really motivated convenors who really wanted to learn how to use the technology.. and that was great, it was really beneficial for both sides. And then we had some convenors who just wanted the designer to make a particular tool or activity or resource, and they just said what they wanted and the designer tried to give some advice, and then pretty much produced what they wanted. (Developer 1)

This was also linked to a sense from Developers that the example units (not being "exemplars" of best practice) could be thought of almost as a work in progress, demonstrating sometimes smaller changes and incremental progress made by the Unit Convenor towards a more interactive or community-based online presence.

> I think there should be a group that charges ahead and looks at the most recent trends and things like that. But on the coalface it does need to be a lot slower and steady and not error-prone, that's really the most important bit. (Developer 3)

Individual roles and responsibilities within the development team of each example unit varied. Developers identified that the development of the example units tended to be an organic process, which did not tend to respond well to prescriptive ideas, or being overly managed, and needed to balance the aims of the Unit Convenor in the unit as well as the aims of the example units project itself.

Developers found that the level of uncertainty about the new system at the time of development, and the inevitable technical problems associated with implementation of a new system, presented some of the key challenges for them in the design and development phase.

Teaching Phase

Unit Convenors
All Unit Convenors interviewed assessed their example units as having worked well when translated to actual teaching, with some pointing out particular tools or features which had been successful. Unit Convenors did not tend to attribute the success of the example units as stemming from the example units process specifically however, as some felt that their own pre-existing learning design had contributed, and that this had remained largely intact from prior to the example units project.

In some cases, particular tools or features were not used or eventually hidden by the Unit Convenor in practice, if they were too difficult to manage in practice or were not successfully realised.

> I didn't really understand [some aspects of the example unit]. And that's not a critique of how the thing went - probably in terms of showing what the [example unit] could do it was good - but in terms of having a unit that I could actually run and manage, it was a bit too much. (Unit Convenor 2)

Developers
Developers' responses to this area of questioning were limited, as often they had only minimal contact with the Unit Convenor following completion of the example unit, and feedback on how a unit, tool or learning design was experienced by students was often only gained in an ad hoc or piecemeal fashion. Where Developers noted various ways in which unit had worked well or not worked well, this was often again linked with the level of engagement of the Unit Convenor, their openness to new ideas, and the extent to which they had considered the learning outcomes and aims of the unit in the design of the online space. The importance and influence of context on the success of a unit design was also highlighted.

> You apply all the principles and so on... but in practice there's a lot more going on there than just design that will make or break it...It's about the whole thing, the package…what sort of teacher the lecturer is and how they personally bring the students along with them. Which is very hard to measure and to get back from the convenor. (Developer 2)

Transmission of Knowledge

A portion of the interview was designed to test the results from Phase 1 of this study, by asking participants if they had looked at other example units, and what they had gained by doing so.

Unit Convenors
While uncertain of the extent to which example units were actually accessed and used by other academics, Unit Convenors were supportive in principle of the example units as learning objects, and emphasised their strengths as a resource for 'just in time' design inspiration and support. All the Unit Convenors interviewed had viewed other example units to some extent, and had picked up at least a few ideas or tips from their designs. In contrast

to phase 1 of this research however, the Unit Convenors did not tend to pick out individual tools or design models as being of particular use to them. The visual aspects of unit design as a way to engage academics were more likely to be brought out by Unit Convenors; the importance and influence of this was borne out by Developers too as a ‘feel-good factor’:

> I looked at the Computing ones and decided I didn’t want lots of little tiny links....And I looked at the hieroglyphics [in another unit] which I thought was just drop-dead gorgeous...I took it home and showed my husband. (Unit Convenor 1)

Developers

Developers endorsed the ongoing utility of example units as learning objects for use in their activities related to supporting the professional learning of other staff. Example units were valued as tangible products with the ability to demonstrate good practice, along with showing the potential for different activities to be applied to different contexts. Developers endorsed the authenticity of the example units and the way that they situated uses of the LMS in the context of a unit with a particular student cohort and set of learning outcomes, rather than presenting them in isolation. “It speaks volumes to academics, because they want to see examples of real units that have used these tools” (Developer 1). The lack of available feedback from students on how they experienced the unit was seen as undermining the usefulness however, and the learning gained from actually running the unit could be a crucial element in using the example in professional learning workshops

One of the example units eventually became the basis for a template on which all of a Faculty’s online teaching spaces have subsequently been based; part of the reason for the choice was that the design of the template had been based on the needs of an authentic unit.

Automated themes - Leximancer

Two concept maps depicting the top six or seven themes for each data set (Unit Convenors and Developers), were produced from Leximancer, and these can be seen in Figure 1. These themes contain clusters of concepts; those that appear together often in the interview data are represented close to one another in the map. The themes are heat-mapped to indicate frequency, which means that the ‘hottest’ or most strongly evident theme appears in red, the next hottest in orange, and so on.

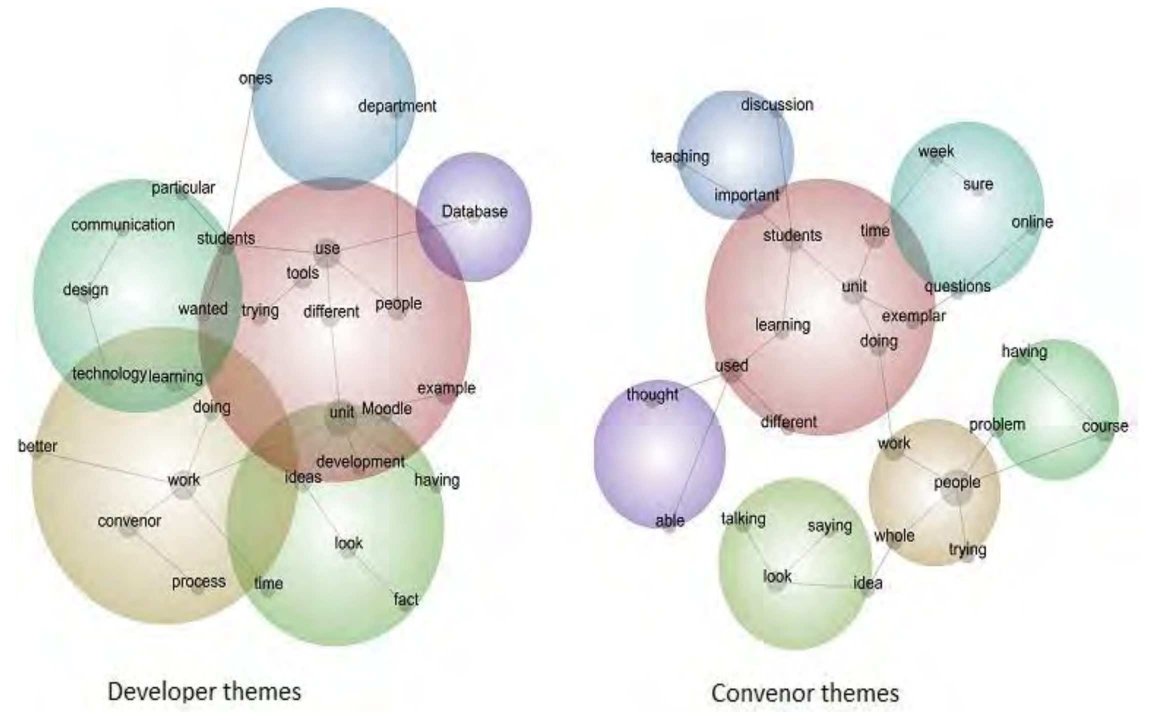

Figure 1. Automated concept maps produced by Leximancer

Analysis of the concepts that emerge through the themes further supports the use of example units for professional development. Similar themes were found in both sets of data, however they can be interpreted in relation to each of the participant's roles. The Developers' themes are associated with *unit*, *work*, *look* and *design* in line with their support role in providing technical and functional expertise. The use of the concept 'communication' in the *design* theme may indicate the importance of building relationships through good communications with Unit Convenors. Similarly, the Unit Convenors associated themes that relate to their work context, with *learning*, *people*, *course*, *week* and *discussion* being prominent. The theme *look* was connected to the concepts 'talking', 'idea' and 'saying' which may indicate that Unit Convenors valued this critical discourse as a way of improving their uptake of technology.

The following summarises the themes (italicised) and associated concepts displayed in Figure 1.
Convenors: (*used*, unit, students, time, doing, learning, exemplar, different)(*people*, work, whole, trying)(*look*, talking, idea, saying)(*course*, having, problem)(*week*, questions, online, sure)(*discussion*, teaching, important)
Developers: (*unit*, use, people, students, example, tools, different, trying, Moodle)(*work*, convenor, learning, doing, process, better)(*look*, ideas, time, development, having, fact)(*design*, wanted, technology, particular, communication)

Discussion

Gunn, Woodgate and O'Grady (2005) argue that engaging teachers in a collaborative, participative design process to repurpose existing learning objects is a highly effective way to produce a sense of ownership, confidence, and knowledge, and ultimately acceptance of organisational change. The focus on repurposing of learning objects is founded in the knowledge that "it may not be practical for every teacher to develop the technical skills to produce learning objects from scratch" (p.195). While we do not dispute the fact that the creation of learning objects using a participative design process would not be scalable to every teaching unit of a large institution, we have found that the application of the same type of collaborative process to the creation of selection of learning objects "from scratch" has had a very similar range of benefits for the staff involved, i.e. a sense of ownership, acceptance, confidence and so on, and that just as importantly, these benefits have filtered out to the wider academic staff as a result of the active learning in the design process.

While to a certain extent some of these benefits were the intended results of the example units project, this study has shown them to be deeper, richer and more complex than might have been foreseen. For example in phase one of the study, 35% of respondents to the survey disagreed that the example units offered opportunities for collaboration in line with other studies such as Handal and Huber (2011) and Taylor (2003). However phase two of the study has afforded the opportunity to investigate this finding in more detail. The true value of the learning objects can be seen to have been located more in the transformative effects of the participative design process that led to their creation itself, rather than in the objects as objects (Kember, 1998). This includes the building of relationships and a community of practice between developers and academics, the professional learning opportunities for the developers themselves, and the impact of the academics' experience of the process on their colleagues. This is brought out by the theme identified through Leximancer of *people* being prominent to both sets of participants.

Unit Convenors themselves validated the participative design process. One participant experienced the collaborative approach as a "match between the academics and [the Developer] group that is explosive in terms of effectiveness of teaching...I would like more of that collaboration, in fact I'd like that collaboration with all my courses." (Unit Convenor 3). The fact that Developers identified the level of willingness to engage on the part of individual Unit Convenors as a critical factor in how successful the example units were as learning objects, also speaks to the influence of the design process.

Hand in hand with the collaborative design process, the importance of scaffolding around example units for academics is also underscored by the data. To maximise their usefulness, example units must not just show tools being used, but also must go some way towards explaining why design choices have been made by the Unit Convenor working with the Developer, and why they are appropriate for that cohort and the unit's learning aims. There is also a need for example units to vary in their level of sophistication and complexity, so as to be accessible and achievable for a majority of academics, who would not enjoy the same level of intensive design and development support to develop their own units. As was highlighted through Leximancer, themes from the Developer's data included 'design', 'technology' and 'tools' as compared to the more contextual concepts in the Unit Convenors' data, which were based around 'learning', 'people' and 'discussion'.

Huber and An (2012) frame the showcasing of the example units as a strategy for encouraging a sense of "relatedness", enabling academics to see the potential benefits for themselves in the new system. Data from this phase of the study has shown that example units indeed acted as an "ice-breaker" for other academics. Seen in this light, the lower than expected number of survey participants in the first phase of this study who indicated that they would revisit the example units may be less significant.

The results of this study have also elucidated a number of ways ongoing initiatives within the institution may be enhanced. For instance, data from participants showed that feedback on how a unit, tool or learning design translated from an example unit was experienced by students in a 'real' unit was often only gained in an ad hoc or piecemeal fashion. This has highlighted a need for more systematised follow-up and evaluation of professional learning and design and development initiatives in order to measure their effectiveness. There are already a number of approaches to measuring impact of professional learning initiatives, see for example Desimone (2009), and use of such a core conceptual framework could be applied to the area of educational design and development.

This study has allowed for a focussed investigation of the effectiveness of an example unit development project, and has brought to light a number of valuable aspects which were not readily apparent in larger-scale quantitative analysis, such as that carried out to evaluate the LMS implementation project as a whole. On the other hand, the limitations of the study are apparent in the number of participants. The reflections reported here are based on a small sample of Unit Convenors and Developers however their thoughtful comments have provided insights for future research and development. The research was carried out within the context of one institution and therefore a cross-institutional study would further justify the findings.

Future Directions

This paper has demonstrated that the value of building example unit lies in the knowledge gained from the collaborative design process between the Unit Convenor and the development team. Looking forward, it is unlikely a project could be sustainable on the scale of one example unit per department, but one example unit per faculty per semester may be more realistic (eight per year). Selection of the Unit Convenors for this development is important. Experience in the study suggests they need to possess not only a motivation to try new approaches and tools in teaching, but also a willingness to reflect on their learning experience and to assist in the learning of colleagues. The educational design and development team work on a number of different projects across the university under different grant and program titles. As trust is built in these projects they would form an ideal, sustainable foundation on which to extract new example units. Student data (de-identified) could add a richness to new example units that was missing in the first ones (reported on here in phase one). New example units could highlight more clearly what works, what didn't and why in the pragmatic fashion of this research study.

Since this project, the faculty-based LMS training and support staff have been reassigned to the Educational Design and Development Group and their role has been expanded to include more educational design aspects. This places them in an ideal position to identify new example units and to further utilize the examples in their training sessions. In this way the examples continue to contribute to the professional learning of the design and development group as well as being available as accessible self-help resources for convenors. A further source for new example units will arise as Moodle, an open source platform, is continually changing. Major upgrades are implemented once a year and example units could be developed to showcase new features of the platform.

A future direction for research is to further examine the perception of "exemplar" as opposed to "example", and investigate which of the two ought to be pursued if the goal is professional learning. As one Developer noted, "if you're putting a link up on the website, the assumption that most staff would make is that you were representing something that was good practice, and that wasn't necessarily the case" (Developer 1). Interestingly, Leximancer confirms this use of the terminology with Developers using 'example' and the Unit Convenors using 'Exemplar'.

A wider study would also be beneficial to compare the findings in this paper across different institutions with different approaches to change management and ways of implementing innovations. Furthermore it would be insightful to include as participants those Convenors and Developers who were not necessarily champions or in support of the changes to the LMS to investigate what can be done to support other groups on the bell curve of distribution of innovativeness (Rogers, 1995).

Conclusion

In the first phase of this study, investigations centered on how a set of learning objects, showcasing a new technology, were utilized. The findings indicated a perception that interaction with the example units had no ‘social’ aspect which leads to assumptions about their effectiveness for learning. Phase two of the study has found that active learning takes place during the design and development process for both sets of participants (Convenors and Developers). The process of developing these example units was also found to be an authentic context in which to situate professional learning. Encouraging a wider uptake in this development process can come about by instigating new ways of working in partnership with the faculty mainstream members supported by the experiences of early adopters.

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Connecting and Reflecting with Ning

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This paper chronicles one instructor's experiences using a social networking site (Ning) to teach two graduate courses in education. It explores the decisions made in setting up the Ning and the affordances of teaching using a blended model of synchronous and asynchronous learning in UOIT's online graduate program. The focus is specifically on the benefits and challenges of using a Ning network and Ning's pedagogical potential for collaborative knowledge construction, the creation of a community of practice, which fosters social presence and multimodal communication.

Keywords: Ning, social networking sites, graduate program, education, digital literacies

Context

At UOIT, where the Faculty of Education has embraced technology and online learning, and where every student has a laptop and ICT use is ubiquitous, it has become much easier to tap into some of the web-based tools available. Web 2.0 tools have become an integral and necessary part of teaching, not only because they are more convenient now to access, but also because the conventional notion of literacy has shifted to reflect a multiplicity of literacies. Contemporary social interaction is characterized by changes in the materiality of texts as well as changes in the ways we make meaning. Kress and van Leeuwen (2001) suggest that in a digital environment "meaning is made in many different ways, always, in the many different modes and media which are co-present in a communicational ensemble" (p. 111).

Why Use a Social Networking Platform?

Digital tools have increasingly become tools of mediation and communication and many facilitate the kinds of sharing that are conducive to literacy education ideals. Although our Faculty has adopted Adobe Connect for use in our graduate program, an additional online platform increases teaching and learning flexibility in a variety of ways. First of all, an asynchronous model allows students to comment outside of the temporal restrictions offered by a synchronous session, which demands their presence for a specific time period. Given that our program is international and we have several students who study with us who live in different time zones, using an asynchronous tool for part of the course allowed those students to participate at times more convenient to them. This is important as our program continues to expand internationally. In addition, the majority of the students in the program were full time teachers with very busy schedules.

Second, a blend of synchronous and asynchronous interaction serves to reach a greater diversity of learning styles. Some students are quieter than others, but this doesn't mean they are not participating fully in their learning. Likewise, some students need more time to reflect before they contribute and the asynchronous model allows them to formulate their ideas with confidence before sharing them with colleagues and the instructor. Within the framework of a three-hour Adobe Connect session, there is limited time for everyone to contribute equally. Within an asynchronous discussion forum, there is no limit on the amount of time students have to post their comments, although discussion around a specific topic might be limited to a certain time frame.

There is simply no denying the popularity of social networking sites like Facebook. With over 750 million active users and more than half of these between the ages of 18 and 34 (Facebook Stats), it is safe to assume that our students, who predominantly fall within this demographic, are already familiar with many of the social practices of social networking tools. As boyd (2006) points out, social networking sites have three defining features. They have a personal profile, they encourage networking through friends' lists, which are publicly articulated, and they allow for semi-persistent public comments, typically on a wall of some kind.

Ning as an Educational Tool for Teaching

The primary benefit of Ning over Facebook or other more open social networking sites is the level of privacy it affords. Although it comes with a price tag, Ning controls enable instructors to establish communities of learning that are accessible only to those who are invited and approved. Moreover, the instructor maintains a certain degree of control over the content that is posted and can keep the learning environment organized to promote effective and efficient use of the space. It is important to note that the graduate students who were using the Ning were predominantly teachers in local school districts, teaching in the K-12 sector, and preparing to become administrators at some future point. Social networking sites such as Facebook, Instagram and Twitter are, unfortunately, still widely unacceptable sites in many school districts. Like Facebook, Ning members are able to "friend" other members, to send virtual gifts to friends, and to use the "like" button for photos or comments posted by others. Unlike Facebook, Ning networks are ad free.

A Ning offers educators the safety elements parents demand while still providing similar features to Facebook.

Members are able to customize their profile pages with their own design, choice of widgets and profile applications so their view on their own computers. In terms of the privacy settings, the network was for members only. Course members were able to invite other members but these new members had to be approved by the instructor as the designer of the network. Students did have the option of cross-posting their own status updates on Twitter and Facebook. In terms of moderation, the instructor did not feel it was necessary to approve students' posts, including the uploading of various media files, before they appeared on the Ning given that the participants were adults.

The Benefits and Challenges of Using Ning

Based on a survey of the research on teaching in online learning environments, specifically social networking sites, Kear (2011) has identified the main benefits and challenges for instructors.

Convenience and Flexibility/Information Overload

As noted above, convenience and flexibility for the students because of busy schedules and geographical locations in different time zones were important factors in the decision to offer the graduate courses using a blend of synchronous and asynchronous communication. For the most part, a flipped classroom model was used by reserving the time we spent on Adobe Connect for group activities and group sharing so the majority of time the students were working in break-out groups, using the white board or notes pages to record their ideas to share with the whole group. The Ning network was use to post pre-recorded weekly comments, typically using SlideRocket, together with some guiding questions for discussion. This was organized through a different forum for each week, simply labelled according to the Week of the course and the topic we were examining that particular week. The discussion was threaded so that students could reply to a colleague's post directly and students could manage their discussions so that they were only "following" certain threads. Within the Weekly forum, students could also create sub-topics related to specific interests. For example, students interested in literacy or science or math education could start their own discussions, but these were open to anyone to follow and participate in. For convenience, participants are notified via email whenever someone comments on a discussion that they are following.

The convenience and flexibility the use of a Ning network offered to students is important; however, the instructor also benefitted in similar ways. Email notifications made tracking efficient and the statistics tool allowed access to each member's statistics to see how many posts they had made, whether these were text based, videos or images, and be taken directly to every post through direct links. Because everyone was expected to be on the Ning for approximately three hours per week, each student's 'voice' was heard individually. As noted earlier, although students collaborated in small break out groups on Adobe Connect, there was no way for an instructor to hear all of those conversations nor can break out groups be recorded.

This kind of active engagement leads to one of the challenges of using a Ning network for both instructor and students. Reading all of the posts and responding where appropriate is very time consuming and creates overload. In total, there were 627 written posts; 141 URLs (links to videos, documents, websites & assignments); 114 embedded pictures & photos; 7 embedded videos/presentations; 31 attachments and 18 blog posts. One can imagine how this kind of volume translates into hours of reading, viewing and responding. While some of the students commented that they were spending more than the additional three hours of "class time" on the Ning each week, when surveyed they unanimously responded that they preferred the blended approach with the use of Ning. These observations support Hung and Yuen's (2010) suggestion that social networking sites like Ning work best when they are used in conjunction with other modes of delivery, particularly face-to-face or online synchronous interaction.

Learning with Others/Low Participation

Collaborative knowledge construction is one of the oft-cited benefits of online learning, but in order for effective learning to take place instructors must foster and develop an "affinity space" (Gee, 2004) or "community of practice" (Wenger, 2000, 2007). Social networking sites position users as co-authors and co-developers and tap into their collective intelligence. They are constructed to facilitate the collection and sharing of ideas and the statistics noted earlier attest to the Ning's capacity to encourage user-generated content. The Ning network fits within the social constructivist paradigm, which views the building of new knowledge as a social and collaborative activity. Creating a sense of community can be challenging and as Mason and Rennie (2008) point out, "online discussions can easily become disjointed with points being made in isolation from others and questions that have been posed never being answered" (91). When a question is posted someone else often responds before I have a chance; however, there were occasions when students created a new forum for their posts instead of posting in the established forum and their thoughts existed in a vacuum. Students who posted comments after the weekly deadline often got no feedback or follow-up from their peers who had moved on to the next topic. Mason and Rennie (2008) identify this as one of the potential disadvantages of online discussion forums, noting that, "collaborative work becomes very difficult to bring to a conclusion when some students have not contributed" (93).

According to Kear (2011), the benefit of learning with others cannot be fully realized unless students actively engage in the process; the problem of low participation needs to be addressed. While all of the students on the Ning participated according to expectations, a small group tended to take the lead and to post as much as three times as often as their counterparts. Although the quantity of postings is not sufficient in evaluating the strength of community development, the number and depth of responses does point to a level of engagement and/or commitment to learning. Lack of participation or untimely participation is more of a problem with fewer students. Some students post early and often, and become frustrated with those who enter the discussion late and do not have as much to contribute. This sometimes happens despite the fact that assessment is tied to activities in the online environment. Whatever the reason, Brady, Holcomb and Smith (2010) argue that using a SNS such as Ning "has the potential to increase student engagement" (152).

Engagement and Belonging/Impersonality

It has been well established in the literature around asynchronous e-learning environments that many individuals view these spaces as impersonal (Hung & Yuen, 2010; Mason & Rennie, 2008) and that individuals might have difficulty being social in these environments (Kear, 2011). Brady, Holcomb and Smith (2005) argue that SNSs may be the answer for online learning because of their potential to enhance the participants' "social presence" (Swan & Shih, 2005; Picciano, 2002). The decision to use a SNS, and Ning specifically,, reaffirms the belief that it is critical for students to be able to articulate who they are and what values, backgrounds, beliefs, and experiences they bring to the learning environment. In this context, learning is viewed as a social practice that is culturally, historically and geographically situated, despite the fact that the Ning allows us to break down spatial barriers. Kear (2011) points to the importance of beginning from "an inviting place" where "contributions should be friendly, supportive and informal" (73). The students' seem to have an intuitive understanding of the social nature of learning, which is evident as they ease into their relationships with each other through casual talk. Scholars confirm that students with a higher social presence online are often more likely to be more engaged in these conversations (cf., Brady, Holcomb & Smith, 2010; Cobb, 2009; Swan & Shih, 2005).

The multimodal affordances of the Ning network draw us into performative relationships with and representations of our "content". To use new media is, in part, to adopt a performative paradigm (Hughes, 2008). Every student took advantage of the multimodal affordances of the Ning network to augment their comments or to share their learning. Some used the Ning blog, others embedded links to their work on web-based technologies such as Bitstrips, Dipity, Glogster, SlideRocket. This kind of multimodal communication does make a difference in an online learning environment. And, this difference is not only in terms of having *more* ways of communicating; it is also a qualitative difference in the ideas that are communicated and the level of student engagement. Accessing information and communicating in a multimodal environment where image, text and sound can come together in one surround adds layers of meaning that might not be conveyed in a strictly print format.

Discussion

This instructor's experiences using a Ning network to teach two graduate courses support the findings of recent studies (Brady et al, 2010; DeSchryver et al, 2009; Hung & Yuen, 2010; Kear, 2011) and confirm the value of this pedagogical tool. As an online learning environment, Ning can foster growth, connection and learning – but building in thoughtful, genuine interaction seems to be a key element in its successful use. This not only underscores the importance of finding tools that align with an instructor's pedagogical goals and theoretical perspective, but also reminds us that how we use the tools is most significant. Even Adobe Connect, with all of its affordances, could be used simply as a lecture platform. Hung and Yuen (2010) suggest that, "hybrid communities mixing online interaction with face-to-face interaction may be ideal" (706). The combination of real-time communication on Adobe Connect, where we can see and hear each other and discuss ideas and issues in small groups, with the Ning network which offers flexibility, convenience and opportunities for more informal social sharing provides a kind of balance that furthers important pedagogical goals.

The multimodal features of Ning enable my students to express themselves through image, sound, gesture (emoticons, gift-giving), colour and various other elements of design. The increased number of ways available for students to communicate with each other does not simply represent a quantitative change. This shift from text-based computer mediated communication to multimodal forms of communication is also a qualitative change. Students can use the multimodal features of Ning to share their ideas and themselves in more creative and unique ways, and as Brady et al (2010) point out, social networking sites attract people, "hold their attention, impel them to contribute, and bring them back time and again" (154). Viewing multimodal communication as performance based and offered up to a wider audience for response is different than in a traditional graduate course where the dominant practice is to write scholarly papers in private and receive confidential feedback from the instructor. The focus here shifts from a model where there is one expert in the "room" to one built on the assumption that collective intelligence, collaborative knowledge construction and shared distribution is valued.

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Designing contemporary music courses for the 21st century musician: virtual worlds as a live music performance space

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The landscape has already changed for the music industry in the way that music is created, performed and distributed. Higher education courses in music, including contemporary music, are abundant but in many cases are not preparing students for the 21st century music industry. Innovative technology is pushing the boundaries of what live performance in music actually entails. Technology such as virtual worlds is opening up avenues for greater control by the musician in relation to design of performance spaces and ability to attract global audiences. The potential for the exploration of virtual worlds by musicians to promote appropriate career development skills is discussed. Technical, organisational and motivational issues are also raised. Problems and possibilities associated with the initial running of performances in a virtual world reveal the capacity of higher education to implement live music performance in virtual worlds as part of their music courses.

Keywords: virtual worlds, music, education, performance

Introduction

Computer mediated environments that facilitate immersion of the user in a 3D space have been written about since the 1950s (Bradbury, 1951; Knight, 1952) and were rudimentarily pioneered in the 1960s with the design and development of Helig's *Sensorama* and Sutherland and Sproull's *The Sword of Damocles* head mounted display (Sutherland, 1965, 1968). In broad terms these experiences have been labeled virtual reality (VR). Development of VR continues with discoveries and developments informing much of the current popular entertainment experiences such as the Kinect, Wii and X-Box. The variety of VR experiences and environments can be categorized as immersive, desktop, projection and simulation (Jacobson, 1993). The type of human-computer interface largely determines these categories. Truly immersive environments require the user to wear equipment that facilitates the immersive experience by blocking out the real world and projecting image and audio through head mounted displays, gloves, position tracking devices and 3D sound systems. On the other hand, desktop VR experience only requires a computer with the specified level of hardware. With the rapid development of computer technology delivering high speed processing, high definition graphics and audio, and high speed Internet connectivity in low cost portable devices, access to VR technology is now possible at a consumer level. VR that can be interacted with using a desktop computer, mouse and keyboard are generally easy to access and as such have been the most likely to be explored in general higher education settings. The type of VR that the authors have explored is what is commonly referred to as a virtual world (VW). The VW is accessed via a desktop computer and interacted with through an avatar that is manipulated using a mouse and keyboard. The type of experience that the user can hope to encounter is what McLellan (1996) calls a window on the world in which the screen acts as a window into which the user is viewing.

Higher education institutions have been introducing the use of VWs as part of their courses in an attempt to meet the increasing demand for anywhere, anytime learning in a highly competitive marketplace (Albion, 2008; Dalgarno, Lee, Carlson, Gregory, & Tynan, 2010; Gregory et al., 2010; Kirriemuir, 2010; Warburton, 2009). Despite a downturn in recent years, the most popular VW used in higher education is Second Life (SL). Other VWs that universities are exploring include their own purpose built and other commercially available VWs and grids including JokaydiaGRID, Kitely, Jibe, World of Warcraft, Reaction Grid, Active Worlds and sim-on-a-stick. The university at which this study took place currently manages three spaces (VW sims often referred to as islands) in the VW SL as well as utilising sim-on-a-stick for single use VW building development. In 2013 a pilot project was undertaken within the Contemporary Music Program examining the experiences of performers and audience participants in live music performances in SL. Staff in the Contemporary Music Programme believe that incorporating SL into the music program will generate an authentic experience for students to develop their performance style and technique, to practice for a real event, to find new audiences and new performance outlets. Most important is the capacity for the VW to be utilised as another real performance space in which performers genuinely earn money and develop an audience.

Background

The project discussed in this paper is located in the Contemporary Music Programme at a regional university in NSW, Australia. The VW SL has already been examined by a number of disciplines within the university including business, management, nursing, tourism and education. Each of these sectors have recognised the potential for SL to enrich the current courses and assist students to develop skills for the 21st century. Unfortunately not all of the initial undertakings in SL have continued and the actual sustainability of VWs in higher education remains a contentious issue. Currently the university manages three islands; a main general purpose island, a nursing focus island and an education research island. On the education research island pre-service teachers are encouraged to consider the use of VWs in their future teaching practice. A small number of education staff and students have embraced the use of VWs for education. The development of a community through extra-curricular events has proved to be one way to encourage participation, as Broadribb et al (2009) describes in the development of a strong SL presence for the Open University, UK. Staff members in the Contemporary Music Programme and the School of Education have begun collaborating to develop music performances that can be attended by staff and students from all sectors of the university. The performances are being held on the education research island and aim to provide an educational experience for the music students and a social experience for the education students.

Literature Review

Music is an important feature of VWs such as SL with a high proportion of SL activities being concerts and night clubs, the streaming of music onto islands as background audio, and the development of social presence and stickiness (keeping people in there and getting people back) through the development of events. As in real life (RL), the aural element is pervasive in the VW, whether as foreground or background music, sound effects, audio cues or ambient sounds. A survey of music destinations catalogued on the SL website list 271 locations with at least one band, *Duran Duran*, having their own category that includes 16 different locations. SL has sub-categories of music that replicate generally accepted genres such as country and folk, live musician spots, pop music, hip-hop, R&B and reggae, rock and metal, electronic and dance, indie and alternative, jazz and blues, cafes and cabarets and live DJ spots. The SL destination listings do not provide a complete picture of music in SL as many spaces stream music to enhance the ambience of their environment or curate musical concerts. Examples of music utilised on SL locations include the Virtual Mine island where the music of the Appalachian mountains are included in the experience, Arkansas State University island has a recreation of Johnny Cash's diner, the Glastonbury Pop Festival SL event on the London island and Languedoc Couer community who hold lavish balls reminiscent of the Baroque period. Further to the utilisation of SL for live music performance by RL musicians is the 2006 concert by Suzanne Vega and the U2 tribute band that perform under the name of U2inSL.

Interestingly Ondrejika (2007), who was at the time the CTO of Linden Lab (the proprietors of SL) and one of the creators of SL, used music as a primary example of why SL was innovative. Importantly he suggested:

> Simultaneous collaboration allows multiple participants to interact in ways not commonly seen on the web, such as musicians in different cities playing a duet to an audience from all over the world. This real-time exchange is at the core of how content is created within Second Life

(Ondrejika, 2007, p. 33).

Content creation is one of the main differences between a VW such as SL and other VWs such as the extremely popular Massively Multiplayer Online Role-Play Games (MMORPG). Antonello et al (2009, p. 45), who undertook a traffic analysis of SL, concluded that while SL and MMORPGs share many characteristics the ability for the user in SL to “build an assortment of objects with distinct network requirements” put added pressure on the requirements and the predictability of those requirements. Traditional MMORPGs have “fixed scenarios and objects that aren’t customisable” and as such only need to adapt to largely predictable player actions. They choose music streaming as the example of high bandwidth requirements to use for their tests. Their results help to illuminate some of the technical requirements for music performance in SL.

Despite the prevalence of music in the VW the inclusion of this mode of performance and distribution is not widely explored in higher education music courses. In 2007 Pence, in his role as the manager of the Pantheon Concert Hall in SL, created an internship program for music industry students from State University of New York – Oneonta. His project involved three staff and nine volunteer students in one semester. The staff played three different roles each as the music educator, the technician and the performance space manager. The students provided publicity and technical support to musicians who were already music performers in SL. Pence found that the concerts that these students organized were very successful and they “required fewer financial resources and entailed fewer risks” than performances in RL (Pence, 2007, p. 3). The project is discussed further in Greenberg, Nepkie and Pence (2008) and cited in Wongtangswad (2008) as one of three examples of the successful use of SL for education. Another example of the use of SL to promote and educate about music can be found in Schwartz (2009). He describes how in 2007 he realized that the immersive and interactive environment of SL had the potential to encourage and motivate others to appreciate Classical Music and he developed a presence for the Music Academy Online. Schwarz at first designed a tower block that had exhibits similar to a museum in RL. He discovered over the first year that people returned to the space when they knew others would be available to talk to or if a concert was programmed. In the second year they purchased a whole island and started to operate “just as a ‘real’ physical world campus” (p. 8). In 2009 Schwartz said that the Music Academy Online would “continue to develop and generate new and unique content with the goal of reaching beyond SL audiences” (Schwarz, 2009, p. 9). It is interesting to note that the examples of Pence and Schwarz discussed here have not continued in SL. Further studies into why educators are not still using SL are underway and necessary to assess why the potential of VWs is not being fully realized. While some have discontinued their use of SL and VWs for music Rogers (2012) demonstrates viability with her ongoing classical style concerts in play since 2007.

The literature is scant in regard to music education in VWs presumably due to the lack of use of VWs by higher education in the discipline of music. A significant reason for advocating for the use of VWs in a music course in higher education is to provide the students with experience in new technologies and new ways to negotiate their music career. As Bartleet et al (2012, p. 34) suggest, “(t)wenty-first-century influences on the Australian music industry such as digitization, globalization and deregulation mean that whichever part of the sector musicians work in, they must navigate new contexts and business models and possess new and diverse skill sets”. One particular aspect of these changes is highlighted by Luthy and Aucouturier (2013, p. 1) observations of the “transition away from the retailing and distribution of fixed objects (records, files) to the consumption of live, interactive events (concerts, happenings)”. Live performance in VWs represents one possible avenue for exploring these new contexts and business models requiring a range of new skills.

Methodology

An action research approach (Kemmis and McTaggart, 1988) has been utilised in the planning, reflecting and redesign of the utilisation of SL in music performance as part of a degree program in music at a regional university. The authors have brought their specific areas of expertise in music and VWs to design and implement opportunities for students to explore VWs. The intention in this pilot phase was to explore the possibilities of VWs as a new media for contemporary musicians and as such an action research methodology is an effective framework to help inform future practice. Three separate performances are discussed and represent three cycles of implementation, reflection and redesign. In semester one of 2013, live performances by staff and students were presented in SL to a variety of audiences and from a variety of RL spaces. The first performance was undertaken by one of the staff and projected to the whole Contemporary Music Programme at the beginning of the semester. The second performance involved ten students who comprised two student band ensembles. They performed in a practice room to an invited audience who were present in both RL and the VW. A third performance was by a band of four musicians, one of which was an honours student in the music program. After the performances the students were interviewed and asked to reflect on their experience and to envisage the future potential of VWs for musicians. The participants offered their perceptions on how they may or may not use SL as a performance space. The feedback from the students was reflected upon by the staff who made changes to the way in which the activity was devised. For each of the performances the students were asked to create their own avatars and were also provided with premade avatars equipped with animation and musical instruments. The same SL space was used for all three performances. This paper describes the setup and technical requirements for each of the three performances. The integration of VWs into the music degree program is further discussed as an important part of the aim to develop the capacity for students to be responsive to changes in the music industry, particularly in relation to technological aspects of music creation and distribution. Much of this aligns with the University graduate attribute (transferable skill) of "lifelong learning – the ability to be responsive to change, to be inquiring and reflective in practice, through information literacy and autonomous, self-managed learning" (SCU, 2013).

Music Performances in Second Life

Solo staff performance

At the beginning of every year the staff in the Contemporary Music Programme give a performance to the whole cohort as a showcase for the staff and to start the weekly concert series. In 2013 one of the authors of this paper chose to use SL as a performance space. His intention was to use the performance as a launch pad to gauge interest from staff and students to SL. As the performance was undertaken during the regular concert time the performer had a high level of technical support from other staff. This was the first time that any of the staff had used SL for performance and the first time that many of the students had witnessed a performance in SL. In the design of the performance the authors had wanted the staff member to perform live from his home. Being able to demonstrate to the students that the RL performance location could be remote from the audience was an important driver for using SL. The concept of performing from home was also attractive to the staff member for a number of other reasons, including familiarity with instrument (an upright piano that could not be moved for the purpose of performing at commercial venues), ease of setup (no need to recreate existing home studio) and general level of comfort in relation to performing from a home studio. The technological requirements for streaming audio into SL were very much akin to home studio recording, with the addition of the live streaming and SL components. Figure 1 shows the desired set up for the solo performance from the staff member's home. Without SL a listener can receive a live feed through the streaming servers URL. However the use of SL adds an extra dimension, that of the avatar. The avatar is the visual representation of the performer and as such requires animating and some attention paid to the avatar by either the performer or a person who may be playing the role of the performer. In the initial design the performer was to have a computer set up with him logged into SL with his avatar. The avatar would be animated as a piano player. The experience for the audience was designed so that they would either come to the performance in SL or view SL projected into the RL concert space at the university campus.

A number of factors caused this initial set up to be changed, helping to highlight a range of technical considerations when performing live in SL. The first problem was the lack of Internet connection at the performer's home due to a recent house move and subsequent delay in phone lines being connected. Unable to perform from home, the contingency plan was for the performance to take place in a studio on the university campus. The authors were still trying to simulate the act of a performance from a remote location. In preparation for the performance occurring on campus a number of tests were done to check the connection to the audio server. In so doing a significant problem was found. The university have shaping tools on their server to restrict students from downloading large amounts of data from the Internet. This tool caused the audio stream to drop out continually. Fortunately an IT technician was willing to make changes to the shaping tool to allow the audio to proceed through to the server. On the day of the performance the studio based setup was working during sound check, however ten minutes prior to the scheduled performance time the computer delivering the live stream ceased working and some frantic troubleshooting proved unsuccessful. This led to the actual performance taking place on stage with a projection of the SL screen featuring the staff member's avatar performing. The late switch in performance location made for a stressful performance due to the staff member not being prepared for the actual performance instrument (a piano with a much heavier action than the home studio or campus studio pianos) and also meant some elements of the performance were not included (e.g., samples triggered from a computer). The final performance in the first instance (during sound check) proved to the technicians and the staff that the set up for live performance in SL was viable. In the second instance (during the scheduled performance) the students were able to see what SL looked like but did not experience the true affordance of SL for live performance as the performer was in the same location as the audience.

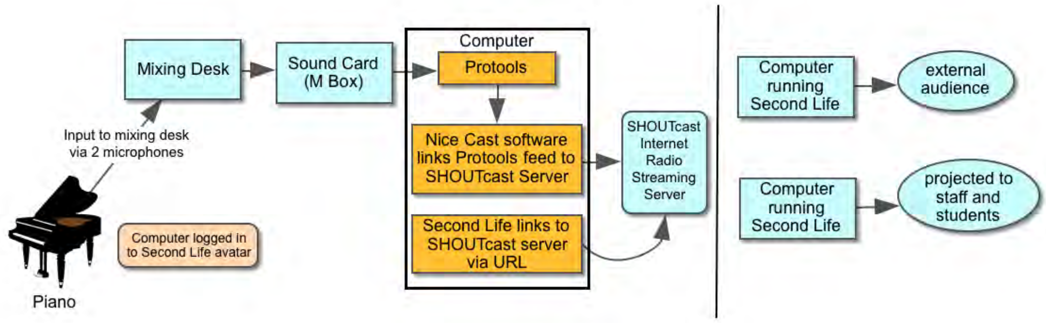

Figure 1: Initial set up for the first performance by a staff member. The vertical line indicates the physical separation of real world locations from the Second Life performance.

Undergraduate student band performances

Every semester students in the music program are put into bands that work together on a set repertoire each week culminating in a final performance. The students are assessed on their participation and performance. To provide students with an initial introduction to the use of SL as a performance medium a small part of an ensemble rehearsal schedule was dedicated to performing in SL. Using the ensemble rehearsal time to stream their performance into SL allowed two ensembles to perform for each other in RL and in SL. As with the staff performance the main audience were either in the RL space or in close proximity to the RL performance, at least two other audience members joined the performance from a remote location. Undertaking a SL performance with most of the audience in close RL proximity greatly diminishes the affordance of SL as a space to perform to a wider audience and/or from a remote location. In turn making it less obvious to the students as to why SL is a valuable space for performance. However the design was as an introduction to SL and the requirements to staging a performance with the hope that the students would experiment with this medium in the future. Prior to the ensemble groups performing in SL, a music student who uses SL as a performance space, doing regular performances and earning a small amount of money from them, made a presentation to the groups extolling the virtues of SL for her as a performer.

The set up for the student performance consisted of two groups of students who alternated being the performers and audience in SL. The performing groups comprised of one group of six (a rock/pop line up featuring drum kit, bass, electric guitars, keyboards and vocals) and one group of four (a rock/pop line up featuring drum kit, bass, electric guitar, and vocals). The initial plan for the performance was for the performing students to be in an ensemble rehearsal room (equipped with PA and instruments) with computer laptops in front of each performer so they could see and interact with their SL avatar. The audience would be in RL in an adjacent room seated at individual computers participating as audience members with their SL avatars. A stereo room microphone setup was put in place with a feed into a computer running the digital audio workstation (DAW), Pro Tools, with an output from the DAW to the Mac based audio streaming application Nicecast to the Internet radio server SHOUTcast. The URL generated by the SHOUTcast server would be added to the streaming audio on the SL performance space

As with the staff performance, a number of technical issues arose in the planning stages, just prior and during the performances. Finding an available bank of computers for students to utilise, both as performers and as audience members in SL, was a challenge. An ideal room for the SL audience, a video editing room equipped with large monitors and high quality speakers, was adjacent to the ensemble rehearsal space, however a different degree program had priority over this room and it was unavailable at the scheduled time for music students. As an alternative, laptop computers for each student were sourced from the university and staff members' personal computers. In pre-session testing it was discovered that the Ethernet ports in the room in which the performance was to take place were not active and an Ethernet cable needed to be fed to a different room to connect the computer streaming the audio at an adequate connection speed. The door to the performance space room door was designed for soundproofing purposes therefore it would not shut properly with an Ethernet cable running through. With the door slightly ajar, the spill from the band playing prior to the performance caused problems for the students working in the room next door further interrupting the preparations. Just prior to the performance the streaming server stopped working. This problem was due to the university shaping tool as discovered prior to the staff performance. While the problem was thought to have been fixed earlier it was discovered that other ports in the building were still affected by this tool. Due to the link to the server being unreliable a decision was made to abandon the audio stream and utilise the 'speak' function within SL to provide the audio feed via a USB microphone. This fixed the sound spill problem, as the Ethernet cable was no longer required, but introduced the problem of much lower quality audio into SL. The final set up is outlined in Figure 2.

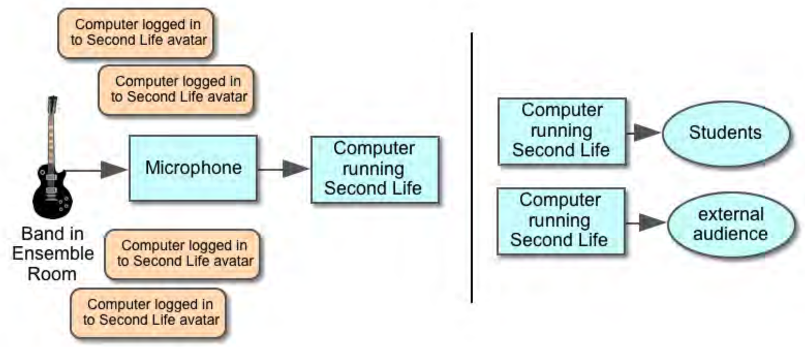

Figure 2: Set up used for the first performance by student ensembles. The vertical line indicates the physical separation of real world locations.

Honours student band performance

A second student performance was arranged with an Honours student who was interested in trialling VW technology after attending the student ensemble performances in SL. The student performed as part of his four-piece instrumental math-metal band in which he is the drummer. A different technical setup from the other performances was used as the band performed from one of the purpose built recording studios at the university utilising a multi-microphone setup and 48 channel mixing desk. A digital multitrack recording of the performance was undertaken using Pro Tools as part of the process. A live stereo mix was fed to a separate computer that was then streamed via the Mac based audio streaming application Nicecast to the Internet radio server SHOUTcast. The URL generated by the SHOUTcast server was added to the streaming audio on the SL performance space (see Figure 3). The band members were each provided with a laptop running SL and these were placed near each performer in the recording studio. Having trialled live performance in SL on the other two occasions the technical audio aspects of this performance came together relatively smoothly. The session proceeded in a similar way to a recording session with the bulk of the time spent setting up microphones, line checking signals and providing a suitable headphone mix for the performers. These tasks were fairly new to the band members but the staff member was experienced in this environment. The performance was scheduled for a Saturday afternoon so there were no distractions from other staff or students and no time pressures other than a self imposed performance time. The shaping tool issue which had interfered with the streaming of the previous student performances had been resolved with technical assistance from the university's IT department. The audio stream into SL was tested 30 minutes prior to the scheduled performance time by means of one researcher in the studio contacting the other at her home by phone to get feedback on the audio quality. From an audio quality perspective the performance was a large step up from the previous student performance (where the 'speak' function had been used) with quality resulting from a multichannel studio recording.

Having mastered the technical requirements of the audio set up the focus turned to the issues of working in SL and what it means to perform in a synchronous visual online space. Only one member of the band (the Honours student) had his own avatar and prior to the performance he had made some effort towards adding set and stage design elements. The band logo had been rendered on a backdrop and the texture behind the stage had been redesigned. The other band members utilised the avatars that had been pre-made complete with musical animations for guitarists and vocalists.

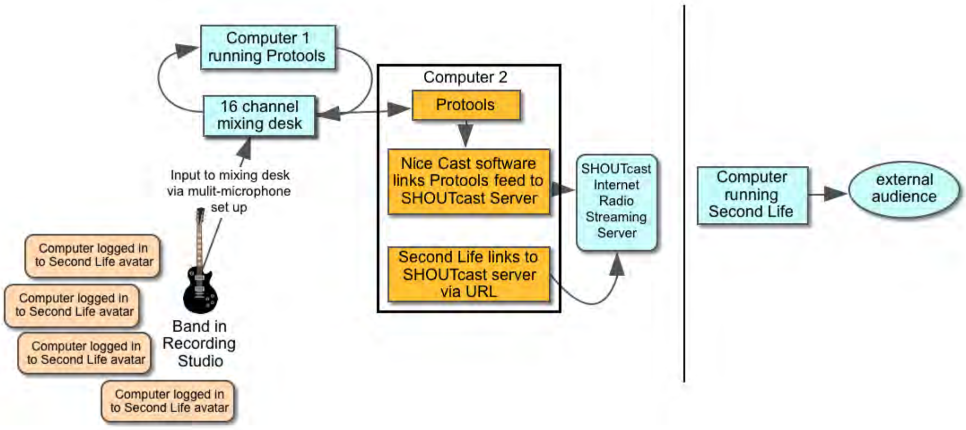

Figure 3: Set up used for the second performance by a student led band. The vertical line indicates the physical separation of real world locations.

Student response to performance in second life

As is often the case, many of the students appeared oblivious to the degree of technical facilitation that staff provided for the performances. For example, the students were asked to make their own avatars in SL before attending the session however of the 14 students who participated only one of them chose to do this. In anticipation of this, prior to the session the researchers had created generic avatars, equipped with animated instruments bought from the SL marketplace, to represent each of the instrumentalists. Before performing, students spent a brief time familiarising themselves with basic SL navigation techniques and exploring some of the avatar animations. There was a high level of engagement observed during the brief introduction with students visibly excited by the capabilities of the avatars and the look of the SL space. During the performances the performing students interacted with their avatars to different degrees. Some ignored their avatar and the computer screen altogether, instead focusing on their performance as they would for a RL performance. Others watched the computer screen as they performed and some changed the animation settings for their avatar in between songs. From an audience in SL perspective, the avatar's animations are an important part of the visual experience. This highlights one of the possible barriers for musicians using SL: the difficulty for the performer to make changes to an avatar's animations whilst they are performing.

The current way that users interact in SL is through their avatar. To manipulate the avatar the user needs to have the capacity to manipulate a device such as mouse, joystick or keyboard. The ability to do this is diminished for a user who is at the same time manipulating a musical instrument in RL. The performer is often engrossed in the act of performing as they interact with their instrument, for them to also interact with the screen via a mouse, joystick or keyboard is very difficult. It is possible for the performer to choose an animation for their avatar to perform while they are playing. This in many ways removes the performer from the immersive experience of the VW. For the audience in SL it is extremely important for them to be able to see an animated avatar to be provided with the right cues to understand that a performance is taking place and not just streaming pre-recorded audio into the SL environment. A device providing a VR immersive experience such that the musicians' RL actions can be tracked (for example, through a device such as the Kinect) may eleviate these barriers. At this time the authors are not aware of any such device and perceive that for a truly immersive live musical performance in a VW such a device will need to be made available. One of the musicians in the math-metal band remarked that if there were more synchronisation of movement between oneself and your avatar that "I'd be there all the time".

Furthermore the students who had previously played RL performances felt that the SL experience lacked the "energy" they associated with live performance. They felt that they were unable to "feed off the crowd" and respond immediately to audience reactions. This feeling reflects the limited time and lack of immersion that the students were engaged in with the SL experience. A seasoned SL performer, who spoke to the students before their performances, suggested that the acceptance of SL as a legitimate performance space that exudes energy and excitement similar to RL performance required time and familiarity with VWs from the performers. The students did agree that there would be value in the potential global audience, however they suggested that existing live video streaming technology was more engaging for such purposes. The students did agree that it would be relatively easy to do a SL gig in future, not having to book through regular channels, not having to cart musical equipment and being able to play in the comfort of their home. One student saw the potential for a strong visual element to be added to the music and suggested that they might construct a dedicated band island in SL. Whilst acknowledging the potential to reach a wider audience, the students thought that most of their audience did not use SL and hence would need to be introduced to SL before being able to experience an SL performance.

Conclusion

The three instances of using SL for music performance primarily demonstrated a number of technical requirements but also lead us to further question how best we can assist students to fully engage with VWs. Our belief in the capacity for VWs to deliver outcomes that are currently unavailable to our students has not been diminished. Through the affordances of VWs a student musician can reach a global audience, perform with a high quality audio sound, practice their performance, can easily access an audience and other musicians with no need to travel and from a remote location. The musician can create a persona through their avatar and develop very specific types of spaces to perform in that all contribute to their musician image. They may choose to have multiple images and reach different audiences.

Presenting live performances in VWs may or may not be a common feature of the future music landscape. However as an exemplar of an emerging technology with a range of possibilities and an as yet to be codified set of practices, VWs offer a suitable context in which students are challenged to respond in creative and innovative ways. In a rapidly changing music industry environment the capacity to be responsive to and to accept and adopt new technologies is an important aspect of any future career in the industry. Such responsiveness is reflected in the notion of lifelong learning. As Smilde (2012, p. 289) suggests:

> In order to meet the challenges of rapidly changing cultural life in the twenty-first century, professional musicians need to be lifelong learners, drawing on a wide range of knowledge and skills. To be successful in a variety of roles, they require a reflective and responsive attitude to change.

We continue to imagine that VWs will become ubiquitous encompassing education and entertainment. The current use of VWs by children provides some insight into the future as they engage with VWs such as *Moshi Monsters* and *Club Penguin*. These children are a musical audience today and tomorrow. In these VWs a music industry exists where children can visit the 'underground disco' and sing 'Moptop Tweenybop' with 'Zack Binspin' then purchase the music through iTunes. When the children of today reach university age they will be expecting VWs to be part of their education.

The small steps that appear to currently be happening in terms of VW adoption are slow indeed. In Australia we hope that an increase in connectivity will assist in making VWs more ubiquitous but expect that that alone will not be enough. Perhaps music will be one of the ways that VWs will be embraced as we have seen with the making of music portable from the walkman to the ipod and in turn the functionality that was designed for mobile devices driven by the desire for music anywhere, anytime. The common thread of music has created communities sharing through technology and that has begun to create a levelling of the music industry hierarchy with performers controlling when, where and for how much they play. In education we may see a music school that meets from all over the world in the VW to discuss, share and perform music and in which accomplished musicians and beginners can play together. These are some of the ways that we envision VWs playing a part in the music education landscape. Introducing our students to the current model and testing the process is a short verse in a longer song not yet written.

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‘It’s not the university experience we were expecting’: digitally literate undergraduate students reflect on changing pedagogy.

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This paper reports from a 2012 small-scale study with campus-based undergraduate students at an Australian research-focussed university. The students’ ownership of learning technologies was examined alongside their appreciation and experience of online learning opportunities. It came to light that a number of the students having opted for a campus- based experience were less willing to embrace fully the wider blend in learning that the learning environment provided. These digitally competent and literate students held a somewhat stereotyped expectation of university teaching as being a didactic process within a classroom with some blend of online learning activities.

The students typically owned a range of personal technologies and they were avid users of one particular social network – Facebook. This preference for a single social network above all others has been found to be true in both prior UK studies (Ofcom, 2012) and US experiences (Dahlstrom, 2012). The students generally considered themselves as consumers of technology to support their learning rather than as engaging with university LMS to transform their learning approach. Suggestions for improving the scaffolding of learning are made.

Keywords: undergraduate experience, technology ownership, pedagogy, social media, LMS

Introduction

With the current emphasis through secondary education on using technology to support learning (see for example the use of iPads in the PEW report, 2012) it is perhaps taken for granted that students embarking on university study will know in advance both the types of technologies they will encounter and the styles of pedagogy which they will meet in their tertiary studies. Students’ prior experience of education however has typically been undertaken in a small-class environment, even if the school or college attended before 18 years of age has a large number of students. Students will have been known personally by their teachers and their progress carefully monitored. Starting university, whether it is a research-based or teaching–focused institution indicates a change of learning environment and for many the opportunity to use more technology to support their studies. The differences between studying at university and their prior educational experience have led to research in the UK *inter alia* on supporting students through the induction process and into settling in to university and has indicated the benefits of providing some scaffolding in their early weeks (Lefever & Currant,2010). However it is not just the social transition from the small-scale home environment to the larger-scale environment of university which will be different but also the approaches to pedagogy and technology support for studying.

Learning management systems (LMS) vary in popularity and availability in pre-university institutions from one country to another but the students who took part in the survey described below had little prior experience of their use. These digitally literate students owned or had access to a wide range of pieces of technology for studying and for personal leisure. They were technically competent and expressed themselves keen to use technology to support their studies but appeared generally unprepared for the changing pedagogy they would meet. The changes which have taken place in many areas of university pedagogy following the introduction of increased use of online materials and a constructivist approach (Dyke et al,2007)leading to collaborative working online and on-campus, appear to have taken some incoming students and possibly their educational advisors by surprise leading to a student approach which can be described as passive and consumer-focussed among undergraduates. In addition the expectation of an approach to pedagogy which adopted a learner-centred paradigm (Barr and Tagg, 1995) was rebuffed in the conversations noted below as not being a part of the experience they had anticipated.

Methodology

A voluntary sample of undergraduate students (n=25), at an Australian university undertook a survey which asked them about their personal technology ownership and their use of technology for their studies. Posters were placed in both an Engineering department and an undergraduate residential college in advance to highlight the timing of open sessions at which students were invited to join a focus group where they would discuss their use of technology to support their learning and to complete the technology ownership questionnaire.

The demographics of the survey and focus groups were: 9 male students and 14 female students. 12 students were studying a range of Engineering degrees and 13 were from programmes across all other faculties. There were 14 1st year students, 3 were on their 2nd year and 8 students were final year undergraduates, 24 of the students were aged between 18 to 21, 1 student was aged between 25to30.

All students completed the questionnaire prior to taking part in focus groups which then introduced a discussion about their use of technology while studying at the University. The survey included questions relating to their prior digital competence and covered their personally owned technology and the technology (the hardware and software) that they might use to support their studies. The immediate source of the questionnaire was from the ECAR studies of student use of technology in HE with a small reduction in the types of technology included (Dahlstrom for Educause, 2012; Salway and Caruso, 2008). The survey is typical of those used in other institutions for measuring student use of technology for learning, for example the University of Edinburgh's annual Freshers' survey (Haywood et al, 2008).

Some quantitative results from the surveys are presented below in graph formats. The focus groups were recorded and transcribed and the results anonymised. The qualitative data from the focus group recordings was analysed to identify salient comments for each question and student opinions from the focus groups are presented under the section of the 'Student Voice' below.

Survey results for student ownership of technology

In this short paper the student ownership of technologies for learning will be primarily considered rather than their use of specific software. Figure1shows the percentage of the students in the focus groups who owned each type of technology. There was 100% ownership of a personal portable computer and a memory stick or portable hard drive. While the ownership of iPads was relatively low at 24%, there was high ownership of iPods (76%) and iPhones (56%). Engineering students owned on average nine items of technology while non-engineers owned somewhat fewer items. Average ownership over 25 students was eight or more items of technology. They owned 35 mobile phones between them: 14 owned an iPhone, 8 owned an Android device, 4 owned Blackberries. There was higher ownership of gaming devices among all Engineers (66%) but ownership was much lower among female non-Engineers (23%). Thirteen females owned a webcam but only three male students owned one. At the other end of the scale, ownership of e-readers was very low since at the time of the survey they were not marketed widely in Australia.

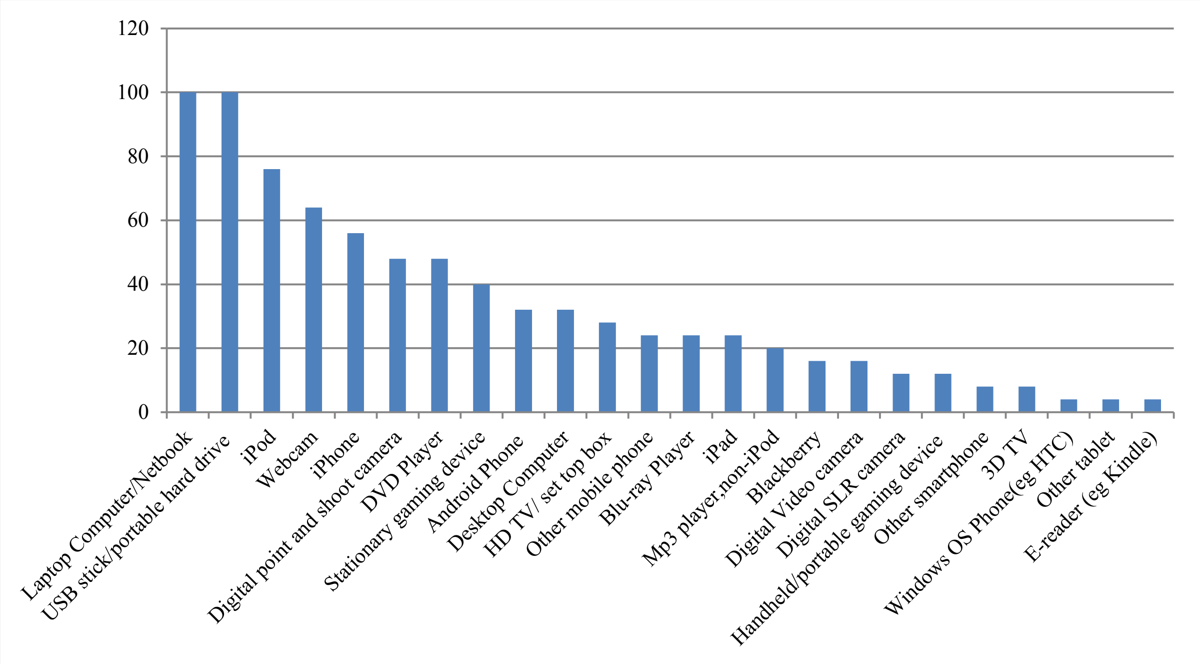

Figure 1Percentages of Student Ownership of different technologies for learning

Student Opinions of Digital Competence

The students in the survey displayed high levels of digital competence which matched the high ownership levels. If they did encounter problems in using their devices they would typically ask a friend for help. The ubiquitous nature of their social networks meant this was easily achieved. A standard comment from this 'digital resident' generation (White & leCornu, 2011) was:

> 'We just know how to adapt to any sort of technology' Female student, non-Engineering

This was in comparison with their perception of the competence of their parents, who would typically be part of the 'digital visitors' generation (ibid):

> 'Our parents' and grandparents' generations struggle with it [technology].'

In terms of the competence of their academic tutors, the students were critical when the former displayed a lack of knowledge and an associated unwillingness to experiment. They reported a few academics as digitally competent, including the example of a tutor using Twitter to keep in touch regularly with students and the creative interactive use of Facebook. They also offered too many examples of academics reluctant to use available institutional technologies, mainly from the non-scientific subjects.

> 'They can't record the lectures because they don't know how to do that …but it's a huge help to us to have it recorded because some lecturers talk [so]fast you cannot keep up.'

Student comments about using technology for learning and its impact on their experience of pedagogy indicated how much they had come to rely on a blend of online and face-to-face engagement but it also highlighted a trend (worrying for some quarters) towards a single commercial product, Facebook instead of the university LMS provision. The lack of flexibility within the LMS for accommodating very large group sizes had persuaded one Dean to move his School's academic support for a first year cohort (in excess of 1200 students) onto Facebook instead. These student comments reiterate their reliance on the social media:

> 'Facebook is good because it is regularly updated within the hour or two. More people respond to it'

The overall perception by students was that many support materials were made available online which had led to a change in pedagogy and a blurring of previous boundaries between academic and personal spaces.

> ‘My use of Facebook has increased exponentially since coming to uni – not really for social stuff but mainly for uni work. I have so many groups now on all these different things for my courses.’

The students’ reflections included comments on other changes in their experiences of pedagogy as they moved from the small-scale to a more ‘industrial-scale’ of learning with a wider use of technology for keeping up with studies.

> ‘At uni, you can’t just get your marks off a teacher here - the size is the main difference’

The students’ description of university technology use indicated a wide variation in the use of learning technologies across the institution with overall greater use being made of a social network that was perceived to be ‘free of cost’ but easier to access and use for supporting their studies, when compared with the university’s investment into the LMS. Here the LMS was not being seen to necessarily support the online group working and the changing pedagogy of the institution. Additionally the commitment for any HE institution to maintain an agile, flexible and continually updated version of their LMS is a significant drain on resources. While there was a clear preference to use Facebook as the dominant social network for working in groups, this was affected by the students in this university lacking confidence to use the local version of Blackboard:

> ‘Facebook has provided an avenue for support and to discuss (and I don’t actually like Facebook but it is really useful). If they set up Blackboard with blogs and so forth people could use that if there was a student private area on Blackboard.’

Discussion

This paper has begun to consider student ownership of technology used for learning within the context of the development of a blend of online and campus-based learning and a more constructivist approach to pedagogy in HE. The current context is one where student ownership of multiple technologies is widespread and a wireless campus environment is widely expected. The results of the inquiry into their software use identified that they frequently access online material through YouTube and similar sources, but rarely post any self-generated material to these sites.

Familiar pedagogical patterns which students have observed at school of a didactic style of teaching in small class cohorts with the teacher imparting ideas and knowledge and a close guidance of student work, was the stated approach that these students expected to be carried on into their university experience. Now they were experiencing a 24/7 approach to learning, where their materials were available online, anytime, anywhere. At university the students experienced a shift in pedagogies to a blend of large-scale classroom and online group working with far less direct contact with the knowledgeable academic expert. In order to manage the complex social side of their learning they had turned almost unanimously to a single social network to provide the support they sought and away from the university provision. The need for more direction on how best to adapt to studying in the new environment is evident while not forgetting that the institution has a responsibility in supporting student learning and offering direction or scaffolding of their learning (Vygotsky, 1986).

There is evidence of a mismatch between students’ widespread access, ownership and adaptability to technology and their current experience of the LMS, which they had not readily adapted to, since it was acceptable and sometimes encouraged to use Facebook instead. While some academics still remain aloof from engaging widely in technology in their teaching, their students use technology as an essential part of their lives and demonstrate a blurring between the personal and study areas of their lives through their use of social media. There are in the author’s opinion concerns to raise where a university allows widespread use of inherently insecure social media for students to support their learning, instead of investing further in the facilities of the LMS and in staff development. A commitment to supporting the LMS with its future opportunities is recommended at institutional level especially as students are increasingly communicating via their mobiles. Academics could be making far wider use of the LMS and of the mobile opportunities that platforms such as Blackboard now offer to mirror the facilities in group work and the swift response to postings sought by students, as they noted above, if local support for academics and wider staff development are taken up.

The student perception can be summarised as seeking a campus-based university with an expectation of learning that would remain teacher and pupil-focussed and closely guided. It should be possible to fully integrate student use of the LMS on arrival, with greater scaffolding of their learning to ease them into the changing pedagogy of HE and offer the best of a blended approach of online and classroom-based activities with reliable and flexible support. Their learning can then take place in a secure environment with proper archiving facilities without students’ risking losing access to their academic material at a later stage of their careers. Further research to explore students' experiences of changing pedagogies and the digital competence of staff and students is planned.

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Immersive Business Simulation Games: an Innovative Pedagogical Approach to e-Learning and Education

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Serious games have been demonstrated to provoke active learners' involvement through exploration, experimentation, competition and co-operation. As a part of serious games, business simulation games are considered as effective tools for the empowerment and mediation of business content learning. They act as serious games which contribute to learning through a simulation of real-life situations and business environments. The blending of designed simulation technology and content curricula offers participants (players, students) a risk-free opportunity to test out a range of relevant strategies to drive business results. By customizing computer-based business simulations, participants can integrate key strategic and financial priorities. This paper provides a brief review of business simulations that serve learning purposes. The first part presents a short introduction and description of business games and their evaluation properties, and the second part provides a brief evaluation and analysis of selected business simulation games.

Keywords: Serious Games, Business Simulation Games, E-Learning, Problem-Based Learning, Education

Introduction

Computers are changing our world: how we work, how we shop, how we entertain ourselves, how we communicate, how we care for our health and the list goes on and on. Shaffer et al. (2005) are arguing will computers change the way we learn? Their answer is yes. Digital games have the potential to change the landscape of education as we know it. From early isolated reports on conferences and books reflecting about possible application of digital games for learning, more and more practitioners and researchers embraced the idea, including the e-learning community (Pivec, 2007). Each year more and different e-learning training products (training courses, training platforms etc.) are developed but most of these products do not exploit the full potential of ICT as contents and methodologies are still the result of adapting the traditional approaches of education and training to the new digital context (Pauschenwein , Goldgruber & Sfiri, 2013). Game-based learning environments (also described as serious games) are gaining wide acceptance in many domains due to a number of contributing educational factors. Over the last 10 years an emerging trend of digital serious games appears integrated in the area of e-learning. Digital serious games have been demonstrated to provoke active learner's involvement through exploration, experimentation, competition and co-operation. They have been seen as good opportunity for supporting learning because of their capability to increase visualizations and challenge the student's creativity (Riedel & Huage, 2011). Serious games have the potential to significantly improve training and education activities and initiatives. The search for new positioning of serious games within university programmes is still an issue of discussion as the changing setting of education by use of gaming is becoming slowly a new form of interactive content, worthy of exploration.

In traditional learning, students often meet with studying literature in form of PDFs, PowerPoint presentations or any other kind of digital media sources. Using the knowledge that has been provided in classrooms and at lectures, real situations can be practiced and simulated mainly by training within the gaming environment. The digital games and simulated real-life process allow learners/students to use their newly acquired skills and knowledge by applying them to a competitive challenge offered within these multimedia tools. There are specific training domains where serious games, learning concepts and approaches have shown a high learning value. Various authors anticipate the great opportunities of games (and simulations) in education, because of their positive effects on learning outcomes e.g. (Hogarth, 2001; Berry, 2007; Bernard, 2006). Serious computer games are part of the new emerging education environment that is based on sophisticated technology with elements of entertainment. Michael and Chen (2006) give the following definition: 'A serious game is a game in which education (in its various forms) is the primary goal, rather than entertainment'.

It is worth mentioning that Corti (2006) has stated that game-based learning/serious games are all about leveraging the power of computer games to captivate and engage end-users for a specific purpose, such as to develop new knowledge and skills.

As a part of digital serious games, business simulation games (Rollings & Adams, 2003), or economic simulation games, are serious games that focus on the management of economic processes (Rollings & Adams, 2006), usually in the form of a business. They can bring the effective methods of learning and experience through business challenges that students usually need to meet before setting foot in the real world. They help students to grasp key business and management concepts and make effective business decisions by using a combination of visual, auditory and hands-on approaches (Duggan, 2013). Because they simulate the real-world system, they can often be used as a teaching method at university level, particularly in business schools, but also for executive education. The benefits of business simulations are in the possibilities to learners to experience and test themselves in situations before encountering them in real life and give them the chance to experiment and test hypotheses (Lean et al., 2006). Being a business simulation game, the participants can select different decisions without any fear for a real loss to the organization in case participants make mistakes. Business simulation games help to model the realities of the business world by simulating basic – and in some cases advanced – business theories and practices in controlled game environments (Farkas, 2007).

Hence, games are an effective tool for mediating learning. Computer games not only convey hard skills such as the understanding of how complex systems operate, production networks being one of them, but also mediate soft skills such as collaboration and communication (Scholz-Reiter et al., 2001). Some games are designed at a very high level intended to fulfil the learning methods, while some games are very poor and do not meet expectations regarding the learning purposes. This paper provides a brief review of the usage of serious simulation games. It presents several types of games that are available and explains their properties in order to help bring educators/learners closer to the possibility of using business simulation games to support their educational aims, objectives and planned outcomes.

Definition and Selection of the Required Game Parameters and Business Simulation Games

The term business simulation game covers a wide range of activities, anything from a card based face to face activity to an interactive online one. It is used to refer to business focused activities designed to develop business acumen and management focused activities designed to improve the way in which an organization is managed. Elgood (2011) define a business simulation games as a device through which individuals learn about how businesses and organizations work, and which enables them to improve their performance within their organization through the development of business and/or inter-personal skills.

It is important that business simulation games are: realistic, engaging and motivating (Trybus, 2013). Good business simulation games (applications) can draw us into virtual environments that look and feel familiar and relevant. According to Dr. Susan Ambrose, director of Carnegie Mellon's Eberly Center for Teaching Excellence, this is motivational because we can quickly see and understand the connection between the learning experience and our real-life work (Trybus, 2013). Within an effective learning environment, we work toward a goal, choosing actions and experiencing the consequences of those actions along the way. This keeps us highly engaged in practicing behaviors and thought processes that we can easily transfer from the simulated environment to real life (Trybus, 2013).

Business simulation games can be usually presented as a training technique in which participants consider sequence of problems and take decisions. The main component is simulation which is based on sequential decision-making exercise structured around a hypothetical model of the operations of an organization. It is important that they help to model the realities of the business world by simulating basic – and in some cases advanced – business theories and practices in controlled game environments (Klabbers, 2009). They have been used as well as in experiments, such as those done by Donald Broadbent who has studied learning and cognition. Those studies have revealed how people often have an attitude for mastering (Hogarth, 2001). Participants can select actions and can have experience regarding the consequences of those actions. The learners/students are using their newly acquired skills and knowledge by applying them to a competitive challenge provided within the business game. The games are essentially numeric, but they usually try to hold the player's attention by using creative graphics. The interest in these games lies in the accurate simulation of real-world events using algorithms, as well as the close assessment the player's actions to expected or plausible consequences and outcomes. An important face of the economic simulations in games is the emergence of artificial systems, gameplay and structures (Remondino & Bussolin, 2011).

However business simulation games come in different shapes, types and sizes. By browsing the vast "ocean" of the business games in computer technology environment, it is become difficult task to find the game that would fit to support all possible business aspects and learning outcomes. In general they can be either too time consuming, too complex for classrooms or too engaging so that any intended educational focus (by educators) appears to be hard to construct (Royle, 2011). For the purposes of this paper, the business simulation games had to be classified according to adequate properties. The first taxonomies and classifications of business simulations were already introduced and presented by Greenlaw et al. (1962). However, according to Biggs (1990), the same taxonomy was used while he attempted to classify the computerized business management simulations. While establishing the background and the nature of the business management simulation, Biggs (1990) states there is no single way to define the classification of business games. Business games can be classified on a number of dimensions. The next attempt to classify business games used in distance education courses was presented by Pillutla (2003). Unfortunately, his classification of business games was merely according to "how they are distributed", which leads to our conclusion that the "web-based" business games do not gather the whole spectrum of business simulation games. For the survey of "web-based" and "non-web-based" business games, Biggs' classification is going to be used.

The evaluation properties have been classified into the two major groups. The first group – **the technical classification** – presents the properties using the technical data that describe the business simulation game and the second group – **the usability classification** – presents the variety of dimensions that describes types of usability characteristics. All properties are described in the following sections and have been used in the Table 1.

Technical Properties

As described above the business games can be classified on the following dimensions:

- Web-Based/Desktop: Whether the game can be played via modern browser or with installation package
- Distribution: Whether the game is free for use, played by license, on CD-ROM, or run by downloaded application/client
- Year of publishing: The year that game was started to be available for public use
- Users: How many registered users the game has (up to 2010)
- Label: The name of the development team
- Single/Multi user: Whether game can be played by one or many players
- Dimension: Whether game is present in 2D/3D environment

Usability Properties

- The time period simulated: E.G. day/week/quarter/year
- Industry specific or generic: In industry specific game, the authors attempt to replicate closely the actual industry. In generic games only general business relationships are replicated
- Degree of complexity: Game decision input variable complexity, or the computer model complexity
- Functional or Total enterprise: Designed to focus specifically on problems of decision-making as seen in one functional area or designed to give participants experience in making decisions at a top executive level and in which decisions from one functional area interact with those made in other areas of a firm
- Competitive or Non-Competitive: Whether the decisions or participants influence the other participants or not

- Feedback system: Whether the results are shown by gained scores, experience points, upgrade level or a summary reports
- Deterministic or stochastic: The stochastic alternative is probabilistic, including chance of elements
- Briefing systems: The level and usability of briefing screen
- Learning objectives: Types of learning skills that can be obtained. E.G. business strategy/ strategic management, finance.
- Background knowledge: Whether a basic/advanced or none business knowledge is recommended in order to play a game
- Interactivity type: In an interactive game participants respond to the questions at the computer, receive an immediate response, and then submit additional decisions. In a non-interactive game decisions are submitted to the game administrator.

Selection of Business Simulation Games

When selecting business games for evaluation, an internet search was conducted, and we were confronted with the countless computerized games that are described as a business games. The World Wide Web provided us with countless lists of business games. The Wikipedia lists hundreds of business games that are listed in alphabetical and chronological order. However, most of the games listed are considered to be more entertainment than edutainment, which takes us out of our focus of selection (so called “tycoon” games that cover different business areas – Zoo Tycoon, Rollercoaster, Hotel Tycoon, can be potentially used as a learning tool or for education purposes, but they are more unlikely to be classified as serious games, because they manly originate from the entertainment industry, and are classified as commercial games).

The second attempt of selection of the business simulation games was made by reviewing business-game-related articles. Riedel and Hauge(2011) have listed 39 serious games that covered topics such as finance, management, product management, industry management, leadership, etc. The list of games has been conducted in 1998 as part of the COSIGA project (www.biba.uni-bremen.de/projects/cosiga/). Since the project is outdated, the list was updated by games that have been developed by GALA project partners (www.galanoe.eu). Another and final updated list of the games was done by the authors, who have personal experience with the games that have additionally been selected.

All together, 30 business simulation games have been tested. Nine of them have shown the highest presence of realistic, engaging and motivating elements (Trybus, 2013) while playing them (for example: attractive graphic environment, real-case scenarios, virtual money, etc). Furthermore, they have been analyzed and evaluated with *usability* and *technical* properties. The following business simulation games have been selected:

INNOV8

The INNOV8, also known as the IBM Business Process Management (BPM) simulation game is a role-playing game that simulates business process management in a 3D environment. The IBM SOA (Self-oriented architecture) team originally created the game to help educate potential SOA clients. The initial version was only open to the academic community and has been in use at over a 1,000 universities and colleges (as far and wide as Beijing and Manchester) since its launch in 2007. The game gives the user a chance to experience and learn about BPM and understand how information and decisions are processed in the business world. The following picture (Figure 1) presents the main virtual character Megan guided by a player.

Figure 1: INNOV8 game (a screenshot of virtual character named Logan)

Virtonomics

Virtonomics is a business-strategy oriented on-line game played as an MMOG (massive multiplayer online game) where the basics of management are tested. It is designed for fans of economic and strategic games, and to study the basics of management. The game itself requires an understanding of laws of real life economy, business and finance, yet players do not need a deeper understanding of economics or any special background education to take part. The game is helpful in meeting interesting people with common interests and making useful connections.

Shark World: A project management game

Shark World is an excellent addition to the basic project management training. It is design to experiment and gain experience with key aspects of project management in a highly entertaining and motivating setting. This on-line game creates a convincing virtual environment in which a project is developed in real time, urging the students of to interfere when things go wrong, or preferably, before they do. The game is played via both the online and mobile channels. Projects develop in (accelerated) real-time (24/7) so players have to keep up with a fast pace and act and intervene immediately. The following picture (Figure 2) presents the GUI (graphic user interface) in the Shark World game.

Figure 2: Shark World (a screenshot of Graphic User's Interface)

eRepublik

eRepublik (www.erepublik.com) is a massive multiplayer online strategic game developed by Republik labs. It is free of use and combines social networking elements (Facebook, LinkedIn, etc.). The game is set in a mirror world called the New World. The players take a role of citizens where they can participate in daily activities. The gameplay is based on a war-time situation which takes a potentially crucial role by increasing the economic or political power of a country. A nation that has experienced and battle-hardened citizens can become a global power and grow global economy business.

Virtual Leader

Virtual Leader is a simulation training game which is focused to develop leadership skills and aspects through various scenarios in a "virtual world". It is a role-playing 3D game with "sim-like" graphical environment. Virtual Leader provides a nice and friendly e-learning platform in a form of "role-play-game" that allows users to develop necessary skills, that are relevant and needed in business environment. The following picture (Figure 3) presents the virtual meeting session in progress, where a player interacts with virtual characters.

Figure 3: Virtual Leader (A screenshot of business meeting at Virtual Leader simulation)

Wall Street Survival

Wall Street Survivor (www.wallstreetsurvivor.com) is a web-based financial (stock market) game with real market data, real stock symbols, and real market tracking, all accounted for on an impressively simulated trading platform. It simulates real-time bid/ask trade fills, as well as streaming profit and loss pages. In order to play the game, a profile account needs to be created and registered. Once a user is registered at Wall Street Survivor, he/she receives an account with $100,000.00 in simulated money to trade with.

The Beer Game

The Beer distribution game, also known as The Beer Game is a role-play supply-chain simulation game that lets students experience typical coordination problems of supply chains without information sharing and collaboration. The purpose of the game is to understand the distribution side dynamics of the multi-echelon supply chain used to distribute a single item, in this case cases of beer. The aim is to meet customer demand for barrels of beer through the distribution side of a multi-stage supply chain with minimal expenditure on back orders and inventory.

Big Oil: Build an Oil Empire

Big Oil: Build an Oil Empire is a business strategy game where users take a role of an oil baron set in times of the oil industry pioneers. They aim to build their own oil empire by taking control of the entire oil business process, from surveying, drilling, and extracting to refining, selling, and market investments. Big Oil lets users build an oil empire by drilling for oil, shipping it to refineries around the world, and eventually processing it into products that can be sold to the public. To play the game user/player can choose from more than 15 scenarios based on historical events such as the Oil Crisis, Lenin's death, Apartheid, etc.

Business Tycoon Online

Business Tycoon Online (bto.dovogame.com) is innovative well known massively multiplayer online game that originated in Asia. The game supports thousands of players simultaneously. It is designed as a business simulator where players must rise to the top of the social ladder as industrial tycoons. Players take the role of an entrepreneur in a virtual business world where they start their own business to break through constant challenges to eventually end with building up a universal corporation or a powerful business empire.

Analysis and assessment of selected business games

Below we present the evaluation parameters and results for the selected games.

Table 1: Evaluation parameters and results.

	eRepublik	Virtonimics	Shark World	IBM innov8	Virtual Leader	Big Oil	Wall Street	The Beer Game	Business Tycoon Online
Web-Based/desktop	Web-based	Web-based	Web-based	Desktop	Desktop	Desktop	Web-based	Web-based	Web-based
Distribution	Republik Labs	Virtonomics team	RANJ	IBM	SimuLearn	Try Sinergy	Wall Street Survivor	MTI Sloan	Dovogame
No. of users	**400.000	**550.000	n/a	n/a	n/a	n/a	350.000	n/a	**600.000
Year of publishing	2008	2009	2008	2009	2003	2006	n/a	n/a	2010
Dimension	2D	2D	2D	3D	2D	3D	2D	2D	2D
Platform	Any	Any	Any	PC-Windows	PC-windows	PC-Windows	Any	Any	Any
Free of use	Yes	Yes	Purchase required	Registration approved	Purchase required	Purchase required	Yes	Yes	Yes
Time period	Min. 1 month	Min. 1,5 month	Min. 1 month	2 to 4 hours	6 to 9 hours	8-10 hours	Min. 1 month	1 to 1,5 hours	Min. 1 month
Industry or generic	Generic	Generic	Industrial	Industrial	Industrial	Industrial	Generic	Industrial	Industrial
Degree of complexity	Low	Medium	Medium	Low	Medium	Low	Low	Low	Medium
Functional or enterprise	Enterprise	Total enterprise	Total enterprise	Enterprise	Enterprise	Functional	Functional	Functional	Total enterprise
Competitive or non-competitive	Competitive	Competitive	Non-competitive	Non-competitive	Non-competitive	Competitive	Competitive	Competitive	Competitive
Feedback system	Experience points	Virtual money income	Customer influence	Points received	Statistic charts	Points received	Virtual money	Statistic charts	Points received
Deterministic or stochastic	Deterministic	Deterministic	Deterministic	Deterministic	Deterministic	Deterministic	Stochastic	Deterministic	Stochastic
Briefing systems	Tutorial video of personal mentor	Poorly supports with mail from virtual administrator	Supported with mails from virtual administrator	The virtual note support	Text instructions and audio/video tutorial	Virtual assistant provided	Text tutorial	Text tutorial	Text tutorial
Learning objectives	Strategy skills, politic-management skills	Strategy skills, politics-management skills	Project management skills, hard skills, soft skills	Business process management skills	Leadership skills	Business strategy skills	Financial skills, stockbroker skills	Coordination, logistic skills	Strategy business – decision making skills
Background knowledge	Not required	Required	Required	Required	Not required	Not required	Required	Not required	Not required
Interactivity type	Yes	Yes	Yes	No	No	No	No	No	No

The legend: ** = the information has been last updated in 2010

Analysis of the result

The place of business simulation games in business education depends on the purpose of their usage and achieved goals. Therefore, business simulation games can be allocated to different types or categories, based on the variety of "learning" content that can be "digested" in order to extract the learning activities. While selecting the most adequate business simulation game, it is important to know that the game scenario must meet the educators or learners expectations. At this point it is important to note that such games must have highly developed segments or levels of reality. The better the imitation of reality in a game is, the more phenomena and the higher level of relations complexity between them are encompassed by the game scenario. Such games enable faster transfer of the experiences of participants directly to their learning target. In our case, Shark World: A project management game was demonstrated as a very good example. Besides the user-friendly GUI (graphic user interface), the game provide us with excellent underlying storyline (which turn as a very entertaining), using fictional characters (played by the real actors) and video material, which give us a nice attempt to feel like to be part of a real business project. Overall, the game brings the right amount of combining entertainment material with educational content. Meanwhile, The IBM's INNOV8 also played a good part in engaging player into the virtual environment. The game consists of rich graphics, cut scenes, scenarios and interesting walkthrough. It gives a good opportunity to explore how to learn about business process management and to collaborate with virtual characters to map out business processes, identify process bottlenecks and explore what-if scenarios. According to the study carried out by Ewing Kauffman Foundation (www.kauffman.org), the game proves to be effective way to engage students by teaching them leadership, project management, innovation and entrepreneurship skills. On contrary, the Beer game gives the impression of a very poor level of user satisfaction. While, the game itself brings a good example of realistic simulation of supply chain and the bullwhip effect which is a well-known phenomenon and a prominent symptom of coordination problems in supply chains, the game shows very poor graphics. The game consists of poor GUI (graphic users interface) and few graphical objects: beer barrels, a transport truck, a factory image and beer storage. Functionally, there is nothing much to do. With no sufficiently presented scenario, players are more likely to be confronted with a subsequent extreme dullness. The similarity of "poor functionality" is Virtual Leader. The gameplay focuses only on choosing the right set of dialogues with virtual characters. Yet, the game provides excellent background materials that bring players up to speed to their involvement and to quickly engage in to the game. On contrary, MMOG business games (Virtonomics, eRepublik, Business Tycoon On-Line), challenge players to get to know the whole functionality of their game-menu and GUIs tool bars without any "quick-to-learn" tutorial support. In general the selected games can be helpful if they demonstrate some aspects of strategy business, decision making processes business management and organization activities that helps in changing the player attitudes and improve better performance.

Evaluation and discussion

Business simulation games use different scenarios and virtual worlds that support player motivation in order to reach the learning goals. They specially try to make a good attempt to capture and combine virtual reality technologies and engaging components of video games in the simulations offered within serious games. Bringing the massive size, resources and technology of video games industry, modern business games are now bringing learners in to an environment where business (management) processes can have a major role. Unfortunately, to this good property many games involve only quantitative variables while ignoring human elements of organization. In order for simulation games to meet the requirements for didactic tools and learning methods, they need to be extremely precise in imitating market realities. The use of an obsolete (outdated) model can lead to a permanently negative opinion of the game participant about this form of education.

In our case, eRepublik turns to be very limited regarding player expectations. On eRepublik related forums, many users have posted complaining comments, for example: not many realistic actions occur in the game (wars are the only factor driving the economy, running companies turns to be too easy, the source and amount of information is limited, etc.) (Khenke, 2011). On the other hand, SimuLearns' Virtual Leader shows us an excellent case how to simulate human behavior in order to practice the tenets of three-to-one leadership with imitations of business meeting sessions which can be mirrored into the real-life situations. Beside the attractive virtual reality, simulation games can keep learners motivated also with monetary rewards. In this case, Wall Street Survivor is not just a mere stock simulator, it provides a competition by giving some attractive real money prizes to the top players in order to keep them motivated. Overall, the games that were selected for our evaluation, demonstrated that it can be helpful if they represent the aspects of business strategy, decision-making processes, business management and organizational activities that helps to change player attitudes and improve performance. They provide user experience in the application of statistical and analytical methods that are used as economic tools.

Evaluation that demonstrates how effective business simulations are and how the measurement of the learning-outcome can be done, still remains a research topic to be explored by education experts and researchers. What we must point out is that many educators may have limited expectations and are threatened by the vast number of available business games. It is also worth noticing that the game-based learning culture is still emerging as many educators are seeing the games as tool that undercuts traditional educational values, promoting anti-social or solitary behavior (Keys & Wolfe, 1990). Table 1 gives the quick review of the usage of serious simulation games in order to bring educators and learners closer to the business simulation games selection for learning and teaching purposes.

Conclusion

The pedagogical barriers to the adoption of serious games as a tool for learning are, perhaps most profound. In short, there is not enough evidence that demonstrates the effectiveness of digital games within an education context. Many still question the transferability of learning – when we play a digital game, particularly one that is ostensibly "educational".

Business simulation games based on the use of the computer and internet capabilities are a reality and they are expected to be the default tool in many areas in the future. Due to their limitations or functionalities many of them will be adapted or re-modeled (Bernard, 2006). Depending on the discipline, an environment can have real character, that is, it exists in reality or a virtual character, and that is, it comes into being through simulation of real phenomena. It can be claimed that business simulation games are perceived as an interesting and desired form of gaining experience that can be used in later professional practice (Wawer et al., 2010).

Business simulation games can be absorbing, provoking and motivated, when participants are being engaged with effective learning (Riedel & Hauge, 2011). It must be noted that playing and testing games selected from the current state of "business games" is not fully sufficient to present the whole knowledge area represented by business education, yet they address the changing competences needed in the information age: self-regulation, information skills, network cooperation, problem-solving strategies, critical thinking, and most important - creativity. But, unfortunately, they can also be to time consuming, to complex for classrooms or to engaging so that any intended educational focus (by educators) appears to be hard to construct (Royle, 2011). Yet different limitations appear, that may or may not support the envisaged educational aims, the educator`s objectives and planned outcomes. Some games have a very high level of complexity intended to fulfil the learning methods and some games are very poor and do not meet the requirements that are expected to foreground the learning purpose. Generally, it is not possible to implement all necessary learning conditions that cover all areas of knowledge. Yet, different games can provide different skills and practice. By defining types of learning outcomes that need to be fulfilled and what fields of business education need to be "trained", the combination of most appropriate games can be created in the sufficiently large and rich set of business games (Royle, 2011). All in all, business simulation games are one of the most important methods of acquiring technical and problem-related knowledge.

Overall, the potential of business simulation games as learning tools will increase given the improving underlying technology, availability of kit, increasing interaction techniques, software's ability to process data, and the increase in gamers (McClarty et al., 2012). When adequately set up, they are a practical teaching-related arrangement that combine the natural predisposition of the players/learners with planned and directed knowledge acquirement. With most other teaching methods, this is rarely the case. At this point, business simulation games should be used as a didactic method whenever conditions meet the learning goals and outcomes.

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Using a Glossary Random Entry Tool on Moodle online learning sites to improve students' engagement – A pilot study

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Making online learning material visually stimulating to students is vital for student learning. Engaging with interactive material that captures the students' attention and develops their interest can be particularly challenging for core 100-level papers. This paper reports an initiative to design a highly visual 'key-concepts' component for the Moodle online learning environment to stimulate students' interest and improve engagement. Key concepts were generated from the 100-level paper -Applied Sciences for Health Professionals - and then presented through a Glossary Random Entry function. The design of each key concept is short, highly visual and easy to understand. We report initial usage statistics of the component compared to other items on the learning site and conclude that the introduction of a highly visual 'key-concepts' does stimulate student interest and engagement with the online learning site.

Keywords: Health Science, Key concepts, Glossary Random Entry, Moodle

Introduction

The origin of this explorative project grew out of a belief that first-year students studying life science papers faced considerable cognitive overload with the 100- level papers. For first-year university students, information overload is a commonly reported issue and particularly pertinent for Health Science papers with heavy content. Students are expected to learn and recognise basic key concepts covering a breadth of topics including microbiology, genetics, nutrition and chemistry and be able to apply them to human health scenarios

Online learning has increased dramatically through the expansion of the computer-mediated learning environment. The cohorts of first year science students are sometimes overwhelmed by the quantity of essential information required for their learning. As educators, it is important we ensure online learning environments do not compound this issue further. This study explores how information overload may be reduced and student interest stimulated.

Many researchers have focused on how to motivate and engage learners in online environments (Dixson, 2010; Jeffrey, Milne, Suddaby & Higgins, 2012; Richardson & Newby, 2006). It is essential to capture students' attention at the start of the course, together with clear content structure and guidelines. Previous studies have shown that optimizing course related technology can facilitate early learning experiences, and improve student engagement, (Chen, Lambert & Guidry, 2010). By drawing attention to specific essential information, learners may be able to visualize and distinguish between more relevant and less relevant information. Stimulating student curiosity and emphasizing relevance may optimize learning through increased student engagement.

In their study, Wong, Leahy, Marcus and Sweller (2012) argued that short sections of information are more effective in creating e-learning resources for students, mainly due to the innate ability to learn by observing, and avoiding long sections which would overload working memory capacity. In addition, diagrammatic and graphical representations have been suggested to reduce the working memory load (Cox, 1999; Zhang & Norman, 1994). In terms of the design of the 'key concepts' component the aim was to present shorter segments of information in order to decrease cognitive load.

Aim

The objective of this project is to develop a highly visual 'key-concepts' component for the Moodle online learning environment to generate students' interest and improve engagement early on in a student's tertiary learning journey.

Method

The key concepts from each topic area from the paper BHlthSci 100-level paper– Applied Sciences for Health Professionals, were selected and presented in a visually attractive way on the Moodle online learning environment by using colours, pictures and tables. The selected key concepts are peer-reviewed by other teaching staff involved within the same paper to ensure appropriate key concepts from each subject area are highlighted, and that they correspond to learning outcomes.

Through the Glossary Random Entry function, key concepts are displayed in a short form, and rotated each time the student refreshes the page. They are linked to associated Power Point presentations and short videos which the students may then access further if they wish. In addition, students will be able to search for the key concepts within a specific topic area, since all of the key concepts are categorised and tagged, based on topic and the date when created.

Output

The tool was developed through the Glossary Random Entry function in the Moodle online learning environment. Selected key concepts are randomly presented on the Homepage. Each time students refresh the screen, a new concept appears. As shown in Figure 1, the Key Concepts appear on the left side of the Homepage, where it is easily visible. The information displayed is short, colorful and highly visual (Figure 1) it does not require further clicking and students will be able to read the information each time they log in to the paper's site. Some of the key concepts were developed with extra links to redirect students to further information if they wish (Figure 2). This online glossary creates a searchable archive of resources. The content is linked to each topic and the date it was created, which makes it simpler for students to locate resources, the major benefit being keeping links and materials off the main course pages. Further key concepts have been added, with sufficient number (about 50 presently) allowing for low level repetition throughout. Repeated information can reinforce students working memory and, ultimately their learning process. This placement on the Moodle online learning environment is likely to reduce extraneous cognitive load within the limit of learners' learning capacity. After a three month trial (July to September 2013), we analyzed students' activity on the Moodle online learning site for this paper (through capture of participants' activity data of 270 students). A far higher number of views for "Key Concepts" were recorded when compared to other online activities, such as course administration, or accessing tutorial files; 716 views for 'Key Concepts' compared to 87 views for 'Tutorial files' (see Table 1). Student discussion groups at the end of the semester will further investigate students' perception of this newly developed study tool.

Table 1: Online activities analysis (Number of students = 270)

Types of activities	"Key Concepts"	Course Administration	Tutorial files	"Did you know?"
Number of views	716	126	87	66

Future work

To take this project further, the next step is to ask for students' participation in the development of the key concepts. The learners themselves will be encouraged to post online their own designed key concepts, so they can be viewed by other learners in the same group. A questionnaire will be added to reveal suggestions and comments from users.

A further development using the Glossary tool is designed to capture students' curiosity, and contains current updated science stories closely related to the individual topics students are learning. This aims at high end learners, who are likely to require extra relevant information within the course to sustain their active learning. This section will be updated each week of the course. By meeting a range of learning needs with the Moodle online environment, students will be more motivated and engaged in their learning process.

Figure 1: Sample of Key Concept location on the Stream site

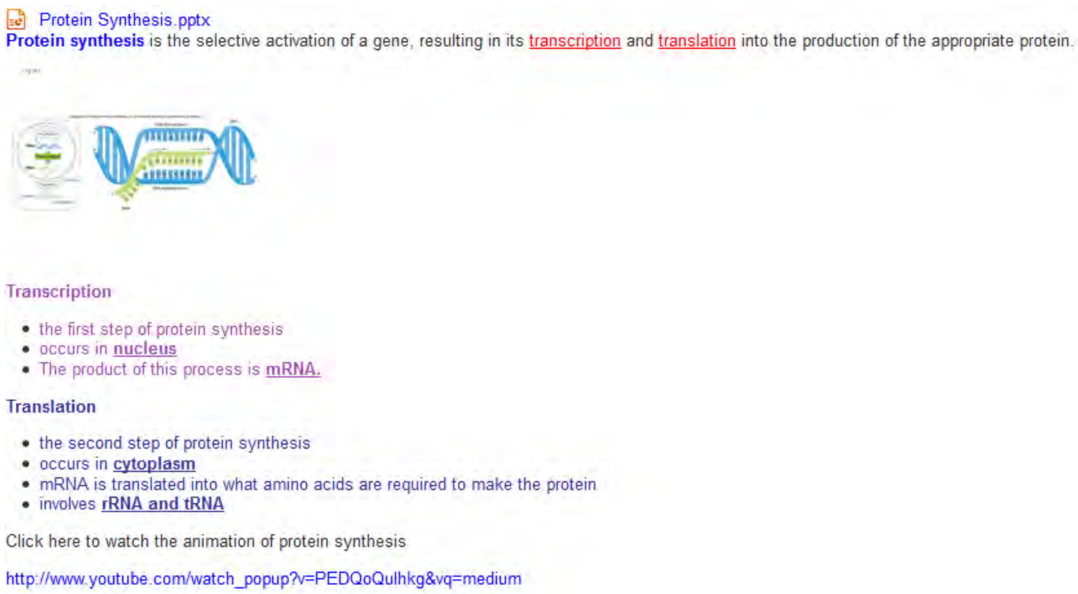

Figure 2: Key Concept sample

Conclusion

This paper records the initial development of a simple visual construction of key concepts through the Glossary Random Entry function in the Moodle online learning environment. Repeated exposure to the key concepts, may help students learn difficult concepts present in the Applied Sciences courses, encourage first year students to engage more actively with the Moodle online learning environment, and, ultimately further improve their learning experience with retention of the health science concepts, and an optimal successful outcome in their core 100-level papers.

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Moving from 'e' to 'd': what does a digital university look like?

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This paper is based on a series of blog posts entitled "A Conversation around what it means to be a Digital University" (MacNeill, Johnston, 2012), which set out the authors ideas about the nature of higher education, eLearning, social media etc. in terms of strategic development within universities. Through the development of a conceptual development framework, we suggest that the exploration of the overarching term "digital university" offers the potential to act as a catalyst for fundamental change throughout an institution from administration to teaching and learning. The aims of the paper are to explore the concept of the Digital University and share an analytical model of strategic change. The authors are currently working with Napier University, Edinburgh as they develop their new digital strategy.

Keywords: strategic development, information literacy curriculum design, learning environments, curriculum design.

Introduction

This paper provides a concise account of on-going work to develop a strategic model for the digital university which can be adapted to meet a variety of institutional conditions and offer flexible tool for engaging staff in identifying and formulating systematic programmes for change.

The Digital University: What is it? How do we achieve it?

The notion of a Digital University seems to be gaining traction within institutions, however we observed that it was being used in a very narrow context, mainly relating to digital technology and infrastructure e.g. repositories and/or VLEs. The exploration of the term Digital University offered the potential to explore central issues for strategic development in a more holistic manner. Digital literacy, is also a term that although increasingly being used in HE is still not commonplace; and again suffers from narrowly focussed discussions particularly relating to computer science related skills and not as a developing set of wider ranging competences. A notable exception is the recent JISC Developing Digital Literacies Programme.

We believe that digital literacy is an extension of information literacy - one cannot exist without the other. The "literacy" of the digital university is the literacy of information. This in turn raises wider social issues of digital inclusion and the role universities can play in the wider community. Figure 1 identifies our key constructs and provides a model of their interrelationship.

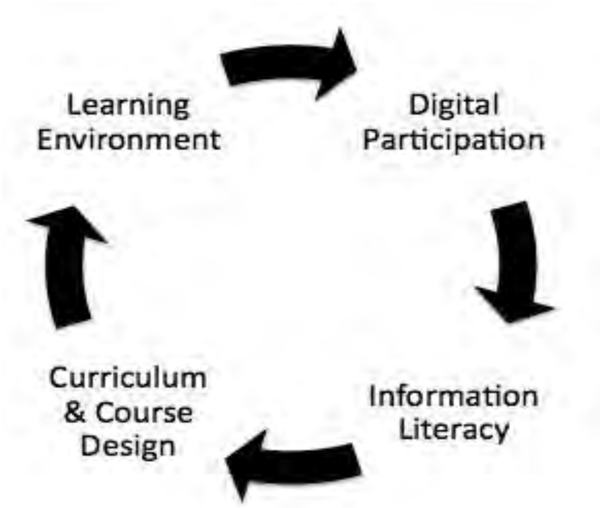

Figure 1: High Level Concepts

The logic of our model starts with the macro concept of Digital Participation which provides the wider societal backdrop to university educational development. Information Literacy enables digital participation and in educational institutions is supported by Learning Environments which are themselves constantly evolving. These elements in turn have significant implications for Curriculum and Course Design. We see educational development as the primary channel to unite the elements of our conceptualisation.

The matrix in Figure 2 develops the four categories in our model to identify the key dimensions of our concept of the digital university. Of the four categories digital participation and information literacy receive much less attention in organizational discourse than notions of learning environment and curriculum. Part of our intention is to redress this by giving more attention to participation and information literacy, with a view to opening up new and productive channels of change and maintaining a broad, but systematic perspective on strategic change. The constructs in figures 1 and 2 therefore represent strategic tools and frameworks, which can be used to analyse existing strategic documents and shape institutional conversations about the practical implications of digital change.

If applied to a university seeking to modernize itself, these four dimensions can channel key activities such as: synthesising the relevant pedagogical literature; analysing particular institutional settings; and identifying plausible lines of action for change.

Digital Participation	**Information Literacy**
*Glocalization *Widening access *Civic role and responsibilities *Community engagement *Networks (human and digital) *Technological affordances	*High level concepts and perceptions influencing practice *Staff & student engagement and development *Effective development and use of infrastructure
Curriculum & Course Design	**Learning Environment**
*Constructive alignment *Curriculum representations, course management, pedagogical innovation *Recruitment and marketing *Reporting, data, analytics	*Physical and digital *Pedagogical and social *Research and enquiry *Staff and Resources

Figure 2: MacNeill/Johnston conceptual matrix (2012)

Exploratory work with the universities of Greenwich, Dundee and Edinburgh Napier has highlighted how the use of this matrix can allow for the development of more holistic strategic frameworks, with multiple points of direct engagement for staff and students.

Connections and Questions

Over the last two years considerable interest has been developed through our series of blog posts about the matrix. We have demonstrated with two different institutions (Universities of Greenwich and Dundee), how use of the framework and matrix can provide a quick analysis of their institutional strategies which can then be used as a stimulus for discussion around digital developments.

Our aim was to model a process using our tools and framework for exploring the notion of a Digital University, which colleagues could adapt and develop; most obviously as part of ongoing institutional conversations aimed at linking the high level statements in pubic strategy documents, to the matter of aligning those statements to major aspects of institutional activity, such as participation, curriculum and learning environment We have also sought to emphasise the importance of Information Literacy to curriculum and course design, as a necessary enabling feature of teaching and learning in response to the growth of digital information resources for education, employability and citizenship. Current work at Edinburgh Napier through the University's Digital Futures Working Group is providing a more in-depth case study of how our model can be adapted and used.

Chaining back through our model/matrix, and in the light of experience, we can now offer some practical advice for modernization projects more generally:

1. That strategic and operational management of learning environment must be a function of course design/re-design and not separate specialist functions within university organizations. To what extent can all stakeholders in the ongoing re-design of all courses to an agreed plan of curriculum renovation?

2. That education for information literacy must be entailed in the learning experiences of all students (and staff) as part of the curriculum and must be grounded in modern views of the field.

3. That participation in all its variety and possibility is a much more significant matter than simple selection/recruitment of suitably qualified people to existing degree course offerings. The nature of a university's social engagement is exposed by the extent to which the full range of possible engagements and forms of participation are taken into account. For example is a given university's strategy for participation mainly driven by the human capital/economic growth rationale of higher education, or are there additional/ alternative values enacted?

Conclusion: Education, digital media and information

The modern digital university is characterized as a blend of familiar undergraduate and postgraduate education, together with community based and workplace learning strands to offer more varied opportunities to a wider range of entrants. This positive development takes form in a more varied portfolio of courses and course designs, which make full use of constructivist learning theory in guiding pedagogy. Lecturing is much more interactive than in the past, and students are engaged through a variety of enquiry-based course designs. Digital information is the key learning resource and Information Literacy is fully developed to maximise the value of investment in technology. We see our model and matrix as pivotal in order to achieve this organizational reform in a holistic and engaging way.

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The IRAC framework: Locating the performance zone for learning analytics

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It is an unusual Australian University that is not currently expending time and resources in an attempt to harness learning analytics. This rush, like prior management fads, is likely to face significant challenges when it comes to adoption, let alone the more difficult challenge of translating possible insights from learning analytics into action that improves learning and teaching. This paper draws on a range of prior research to develop four questions – the IRAC framework - that can be used to improve the analysis and design of learning analytics tools and interventions. Use of the IRAC framework is illustrated through the analysis of three learning analytics tools currently under development. This analysis highlights how learning analytics projects tend to focus on limited understandings of only some aspects of the IRAC framework and suggests that this will limit its potential impact.

Keywords: learning analytics; IRAC; e-learning; EPSS; educational data mining; complex adaptive systems

Introduction

The adoption of learning analytics within Australian universities is trending towards a management fashion or fad. Given the wide array of challenges facing Australian higher education, the lure of evidence-based decision making has made the quest to implement some form of learning analytics "stunningly obvious" (Siemens & Long, 2011, p. 31). After all, learning analytics is increasingly being seen as "essential for penetrating the fog that has settled over much of higher education" (Siemens & Long, 2011, p. 40). The rush toward Learning Analytics is illustrated by its transition from not even a glimmer on the Australian and New Zealand Higher Education technology horizon in 2010 (Johnson, Smith, Levine, & Haywood, 2010) to predictions of its adoption in one year or less in 2012 (Johnson, Adams, & Cummins, 2012) and again in 2013 (Johnson et al., 2013). It is in situations like this - where an innovation has achieved a sufficiently high public profile – that the rush to join the bandwagon can swamp deliberative, mindful behaviour (Swanson & Ramiller, 2004). If institutions are going to successfully harness learning analytics to address the challenges facing the higher education sector, then it is important to move beyond slavish adoption of the latest fashion and aim for mindful innovation.

This paper describes the formulation and use of the IRAC framework as a tool to aid the mindful implementation of learning analytics. The IRAC framework consists of four broad categories of questions - **I**nformation, **R**epresentation, **A**ffordances and **C**hange – that can be used to scaffold analysis of the complex array of, often competing, considerations associated with the institutional implementation of learning analytics. The design of the IRAC framework draws upon bodies of literature including Electronic Performance Support Systems (EPSS) (Gery, 1991), the design of cognitive artefacts (Norman, 1993), and Decision Support Systems (Arnott & Pervan, 2005). In turn, considerations within each of the four questions are further informed by a broad array of research from fields including learning analytics, educational data mining, complex adaptive systems, ethics and many more. It is suggested that the considered use of the IRAC framework to analyse learning analytics implementations in a particular context, for specific tasks, will result in designs that are more likely to be integrated into and improve learning and teaching practices.

Learning from the past

The IRAC framework is based on the assumption that the real value and impact of learning analytics arises from its integration into the "tools and processes of teaching and learning" (Elias, 2011, p. 5). It is from this perspective that the notion of Electronic Performance Support Systems (EPSS) is seen as providing useful insights as EPSS embody a "perspective on designing systems that support learning and/or performing" (Hannafin, McCarthy, Hannafin, & Radtke, 2001, p. 658). EPSS are computer-based systems intended to "provide workers with the help they need to perform certain job tasks, at the time they need that help, and in a form that will be most helpful" (Reiser, 2001, p. 63). This captures the notion of the performance zone defined by Gery (1991) as the metaphorical area where all of the necessary information, skills, and dispositions come together to ensure successful task completion. For Villachica, Stone & Endicott (2006) the performance zone "emerges with the intersection of representations appropriate to the task, appropriate to the person, and containing critical features of the real world" (p. 540). This definition of the performance zone is a restatement of Dickelman's (1995) three design principles for cognitive artefacts drawn from Norman's (1993) book "Things That Make Us Smart". In this book, Norman (1993) argues "that technology can make us smart" (p. 3) through our ability to create artefacts that expand our capabilities. At the same time, however, Norman (1993) argues that the "machine-centered view of the design of machines and, for that matter, the understanding of people" (p. 9) results in artefacts that "more often interferes and confuses than aids and clarifies" (p. 9). A danger faced in the current rush toward learning analytics.

The notions of EPSS, the Performance Zone and Norman's (1993) insights into the design of cognitive artefacts – along with insights from other literature – provide the four questions that form the IRAC framework. The IRAC framework is intended to be applied with a particular *context* and a particular *task* in mind. A nuanced appreciation of *context* is at the heart of mindful innovation with Information Technology (Swanson & Ramiller, 2004). Olmos & Corrin (2012), amongst others, reinforce the importance for learning analytics to start with "a clear understanding of the questions to be answered" (p. 47) or the *task* to be achieved. When used this way, it is suggested that the IRAC framework will help focus attention on factors that will improve the implementation and impact of learning analytics. The following lists the four questions at the core of the IRAC framework and briefly describes some of the associated factors. The four questions are:

1. Is all the relevant **Information** and only the relevant information available?
   While there is an "information explosion", the information we collect is usually about "those things that are easiest to identify and count or measure" but which may have "little or no connection with those factors of greatest importance" (Norman, 1993, p. 13). This leads to Verhulst's observation (cited in Bollier & Firestone, 2010) that "big data is driven more by storage capabilities than by superior ways to ascertain useful knowledge" (p. 14). There are various other aspects of information to consider. For instance, is the information required technically and ethically available for use? How is the information to be cleaned, analysed and manipulated? Is the information sufficient to fulfill the needs of the task? In particular, does the information captured provide a reasonable basis upon which to "contribute to the understanding of student learning in a complex social context such as higher education" (Lodge & Lewis, 2012, p. 563)?

2. Does the **Representation** of the information aid the task being undertaken?
   A bad representation will turn a problem into a reflective challenge, while an appropriate representation can transform the same problem into a simple, straightforward task (Norman, 1993). Representation has a profound impact on design work (Hevner, March, Park, & Ram, 2004), particularly on the way in which tasks and problems are conceived (Boland, 2002). In order to maintain performance, it is necessary for people to be "able to learn, use, and reference necessary information within a single context and without breaks in the natural flow of performing their jobs." (Villachica et al., 2006, p. 540). Olmos and Corrin (2012) suggest that there is a need to better understand how visualisations of complex information can be used to aid analysis. Considerations here focus on how easy is it to understand the implications and limitations of the findings provided by learning analytics?

3. Are there appropriate **Affordances** for action?
   A poorly designed or constructed artefact can greatly hinder its use (Norman, 1993). For an application of information technology to have a positive impact on individual performance it must be utilised and be a good fit for the task it supports (Goodhue & Thompson, 1995). Human beings tend to use objects in "ways suggested by the most salient perceived affordances, not in ways that are difficult to discover" (Norman,

1993, p. 106). The nature of such affordances are not inherent to the artefact, but are instead co-determined by the properties of the artefact in relation to the properties of the individual, including the goals of that individual (Young, Barab, & Garrett, 2000). Glassey (1998) observes that through the provision of "the wrong end-user tools and failing to engage and enable end users" even the best implemented data warehouses "sit abandoned" (p. 62). Tutty, Sheard and Avram (2008) suggest there is evidence that institutional quality measures not only inhibit change, "they may actually encourage inferior teaching approaches" (p. 182). The consideration for affordances is whether or not the tool and the surrounding environment provide support for action that is appropriate to the context, the individuals and the task.

4. How will the information, representation and the affordances be **Changed**?
The idea of evolutionary development has been central to the theory of decision support systems (DSS) since its inception in the early 1970s (Arnott & Pervan, 2005). Rather than being implemented in linear or parallel, development occurs through continuous action cycles involving significant user participation (Arnott & Pervan, 2005). Beyond the systems, there is a need for the information being captured to change. Buckingham-Shum (2012) identifies the risk that research and development based on data already being gathered will tend to perpetuate the existing dominant approaches from which the data was generated. Bollier and Firestone (2010) observe that once "people know there is an automated system in place, they may deliberately try to game it" (p. 6). Universities are complex systems (Beer, Jones, & Clark, 2012) requiring reflective and adaptive approaches that seek to identify and respond to emergent behaviour in order to stimulate increased interaction and communication (Boustani et al., 2010). Potential considerations here include, who is able to implement change? Which, if any, of the three prior questions can be changed? How radical can those changes be? Is a diversity of change possible?

It is proposed that the lens provided by the IRAC framework can help increase the mindfulness of innovation arising from learning analytics. In particular, it can move consideration beyond the existing over emphasis on the first two questions and raise awareness of the last two questions. This shift in emphasis appears necessary to increase the use and effectiveness of learning analytics. The IRAC framework can also provide suggestions for future directions. In the last section, the paper seeks to illustrate the value of the IRAC framework by using it to compare and contrast three nascent learning analytics tools against each other and contemporary practice.

Looking to the future

The Student Support Indexing system (SSI) mirrors many other contemporary learning analytics tools with a focus on the *task* of improving retention through intervention. Like similar systems, it draws upon LMS clickstream *information* in combination with data from other *context* specific student information systems and continuously indexes potential student risk. Only a very few such systems, such as S3 (Essa & Ayad, 2012), provide the ability to *change* a formula in response to a particular context. SSI also *represents* the information in tabular form, separate from the learning context. SSI does provide common *affordances* for intervention and tracking, which appear to assist in the development of a shared understanding of student support needs across teaching and student support staff. Initial findings are positive with teaching staff appreciating the aggregation of *information* from various institutional systems in conjunction with basic *affordances* for intervention facilitation and tracking. In its current pilot form, the SSI provides little in terms of *change* and it is hoped that the underlying process for indexing student risk, tracking student interventions and monitoring students interventions can be *represented* in more contextually appropriate ways in future iterations.

The Moodle Activity Viewer (MAV) currently serves a similar *task* as traditional LMS reporting functionality and draws on much the same LMS clickstream *information* to *represent* student usage of course website activities and resources. MAV's *representative* distinction is that it visualises student activity as a heat map that is overlaid directly onto the course website. MAV, like many contemporary learning analytics applications, offers little in the way of *affordances*. Perhaps the key distinction with MAV is that it is implemented as a browser-based add-on that depends on a LMS independent server. This architectural design offers greater ability for *change* because it avoids the administrative and technical complexity of LMS module development (Leony, Pardo, Valentın, Quinones, & Kloos, 2012) and the associated governance constraints. It is this capability for *change* that is seen as the great strength of MAV, offering the potential to overcome it's limited affordances, and a foundation for future research.

BIM is a Moodle plugin that manages the use of student selected, externally hosted blogs as reflective journals. It is posts written by students that form the *information* used by BIM, moving beyond the limitations (see Lodge & Lewis, 2012) associated with an over-reliance on clickstream *information*. Since BIM aims to support a particular learning design – reflective journals – it enables exploration of process analytics (Lockyer, Heathcote,

& Dawson, 2013). In particular, how process analytics can be leveraged to support the implementation of *affordances* for automated assessment, scaffolding of student reflective writing, and encouraging connections between students and staff. Like MAV, the work on BIM is also exploring approaches to avoid the constraints on *change* placed by existing LMS and organisational approaches.

The IRAC framework arose from a concern that most existing learning analytics applications were falling outside the performance zone and were thus unlikely to successfully and sustainably improve learning and teaching. Existing initiatives focus heavily on information, its analysis, and how it is represented; and, not enough on technological affordances for action and agility to change and adapt. Drawing on earlier work from the EPSS and other literature we have proposed the IRAC framework as a guide to help locate the performance zone for learning analytics. The next step with the IRAC framework is a more detailed identification and description of its four components. Following this we intend to use the framework to analyse the extant learning analytics literature and to guide the development and evaluation of learning analytics applications such as SSI, MAV and BIM.

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A Pilot Trial of Social Media in a Technical Area

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This paper reports on a project undertaken to trial social networking with Telecommunications students and staff from Swinburne University of Technology. Web 2:0 technologies including social networking sites can encourage informal conversation, dialogue, collaborative content generation, and knowledge sharing, giving students access to a wide range of ideas. A Ning was used with the intention of engaging students and staff in informal discussions relating to the Telecommunications industry in general, rather than course material directly. Although staff contributed enthusiastically and a large number of students enrolled, student participation was low. Follow-up surveys and informal discussions revealed reasons for the low student participation included the risk of appearing foolish in front of peers and teachers, and an intention to use the Ning in a passive manner by seeing what others are doing without necessarily contributing themselves. We conclude that social media in education may be useful but needs some incentive for it to be adopted by students.

Keywords: Social networking, student engagement, Ning, community

Introduction

This project investigated the effectiveness of using social networking in a controlled blended learning environment using the Ning platform. Telecommunication Engineering staff in the Faculty of Information and Communication Technologies used social networking to communicate with students, in addition to the Learning Management System (LMS) that the university provided. Social networking was used to supplement both the LMS and face-to-face units as a means of enhancing students' sense of community. Social networking is defined by Gunawardena et al (2009) as "the practice of expanding knowledge by making connections with individuals of similar interest" (p. 4). The principles of social networking sites such as Facebook, designed to encourage social interaction and information exchange amongst those connected should form the basis of communities of practice, especially in a controlled educational environment. However, higher education has been slow in adopting social networking technologies into the curriculum (Brady, Holcomb, & Smith, 2010), despite the proliferation of social networking sites.

Typically, users of social networking sites can share personal information, connect with other users, upload, tag and share multimedia content (Lockyer & Patterson, 2008), thus facilitating communications with others. The Telecommunications Engineering staff wanted to create an online community for students studying their subjects so they could have a sense of belonging and the ability to meet other students who shared this common interest. This type of community can be described as "a specific type of psychological community based on the following characteristics: (a) the setting is the world of education; (b) the primary purpose is learning; and (c) the community is based on a fixed organizational tenure, that is, a set length of the course or program in which members are enrolled" Rovai (2001, p. 287). Based on this definition, the Telecommunications staff wanted to foster an online community in addition to the face-to-face class contact times for their students. As students are "no longer passive consumers but active producers of knowledge" (McLoughlin & Lee, 2008, p.1) a platform that utilised Web 2.0 technologies was chosen. A private social network, Ning (www.ning.com), satisfied this requirement as the online platform to create the Department's own social network. The customisable appearance and feel of the Ning was chosen as the social network of choice for this purpose. A Ning delivered the medium to create a community website with common social network features such as the ability to share photos, upload videos, create a profile page and participate in forums and blogs.

Given that students "are finding new ways to contribute, communicate and collaborate using a variety of tools that empower them to share ideas" (McLoughlin & Lee, 2008, p. 1) it was envisaged that providing such a medium would assist their participation in Departmental activities, discussions and communication amongst students and staff. Tools such as blogs, wikis, media sharing applications and social networking sites can support and encourage informal conversation, dialogue, collaborative content generation, and knowledge sharing, giving learners access to a wide range of ideas and a sense of community building (Dennis, 2008). Whilst students know how to use social networking sites, "the challenge is to apply it to education" (New Media & EDUCASE, 2007, p. 12) and as a supplementary learning tool, social networks "holds promise for enhancing students' sense of classroom community, which contributes to their classroom community of practice in an out of class" (Hung & Yuen, 2010, p. 713).

Blackboard, the University's designated learning management system where course materials are stored, tends to be "very focused and lack the personal touch and networking capacity that social networking sites offer" (Brady et al., 2010, p. 152). It was for these reasons that the Department chose to offer another medium to separate the course materials from the social aspect of the platform. Additionally, as participation in the Ning was not compulsory, unlike Blackboard, non-examinable material materials were posted to encourage and promote topical discussions such as Australia's National Broadband Network, but not to disadvantage those students who did not want to participate. The Telecommunications Engineering staff engaged with the students through the Ning by contributing regularly to the forums, uploading pictures, highlighting topics that were not examinable but rather of interest to students to encourage discussion. The overall goal was to provide students with a broader perspective on their discipline and also give them an understanding of the technical and research interests of academic staff. The Departmental staff modeled the skills themselves and engaged students with a 21st century approach to teaching using social networks (Ozkan & McKenzie, 2008).

Method

Research Question

This project, explored the possibility of whether the population of a Ning for Telecommunications students would assist in increased student engagement. It also investigated the views of academic staff and the perceived benefits from exploiting the use of social networks and Web 2:0 technologies.

Participants and Settings

Students studying telecommunications engineering subjects were invited to join the Telecommunication Ning with 81 students signing up. The Ning was active for the entire 2012 academic year. Staff and students used the Ning throughout the semester and then were surveyed about the usage of the Ning via an online Opinio survey. The Ning was used as a teaching tool by lecturers teaching Telecommunications subjects and contained supplementary material of interest to students. Students who choose not to participate in using the Ning were not disadvantaged, as it did not contain core course material. Core material pertinent to the course was stored on Blackboard: the University's learning management system.

The Ning was used as a medium to encourage communication and engagement of Telecommunications topics that may be in the popular media such as the NBN. Staff posted blogs, activities, Twitter feeds and information about happenings in their area, which were of interest to students. Academic staff did not initiate posts on their curriculum to ensure that students who did not participate in the Ning were disadvantaged. Upon acceptance of the invitation to join the Ning, students created their own member page, and interacted with the staff and other students through forums and blogs.

Data Collection

A questionnaire was administered towards the end of the project via an online Opinio survey for students and a separate one for staff. The designated questionnaire for students was structured in such a way to determine whether they regularly used social media such as Facebook, Kik, Snapchat and the extent of use calculated over an average week. This then allowed the researchers to determine if the Ning was a natural extension to their current social media usage. Specific questions relating to the Ning were also asked such as:

- Did you engage more through the Ning, then what you might have in person?
- Did you find the Ning helpful in assisting you make contacts within the Telecommunications discipline?
- Do you have a greater understanding of your lecturer's interests?
- What did you find most useful in using the SwinTelecoms Ning?
- Do you think it increased your engagement in this subject by using a Ning?

The purpose of the questionnaire was to allow some subjective input from the students and to determine their perception of the value of the Ning. Student responses could then be correlated with quantitative measures of active participation via student contributions to the Ning website.

The questionnaire remained open for a month and several reminders were sent out during that month to encourage as many students & staff as possible to participate. Despite the reminders, eight students and four staff voluntarily completed the questionnaires. The lack of student participation in the questionnaires can be attributed to research fatigue experienced by students who have been over committed (Clark, 2008; Schuh, 2009). The study did not ask students to comment on the actions of staff members, but merely the use of the Ning as a technological tool compared with what they experienced and/or expected. The questionnaires were anonymous, and any identifying information was removed. Participants were assured that the results of the study would be solely used for research purposes to improve the teaching and learning methodology, and would have no effect on their current or final results. The project received Human Research Ethics approval from the University and all participants contributed on a voluntary basis.

The questionnaires were administered online using Opinio in the last four weeks of semester to both students and staff. The student questionnaire had 24 questions, whereas the staff questionnaire had 18 questions, with both having a combination of pull down lists, radio buttons and text boxes for further comments. The participation in the Ning and the subsequent questionnaire was voluntary. 81 students joined the Ning, however only eight students completed the questionnaire, which represented approximately 10% of the participants. Four staff members completed the staff questionnaire.

The research team met regularly and discussed the analysis of data several times to ensure internal validity of the process and agreement about the interpretation. Entries to survey tick data were compiled to provide quantitative data. Free text entries were read repeatedly to enable the coding and categorisation of responses, then counted to enable quantitative comparisons. This qualitative data analysis method was informed by the work of Boyatzis (1998) and Bogdan and Biklen (2007).

Findings

While students initially enthusiastically enrolled in the Ning their level of contribution was disappointingly low. Their sporadic use of the social network coupled with their lack of interaction suggested that students were not interested in engaging with staff and other students. The survey we carried out towards the end of the trial and informal discussions with some of the students later, pointed to the following as possible reasons why the Ning did not foster a community of practice amongst students. Some participants said they found contributing to an online discussion on technical matters with their instructors intimidating. There was some fear that they might appear foolish. Some participants felt that they did not have anything more to add to the discussion and that they did not believe their contribution would be valued. This was potentially exacerbated because their student name was used and there was no anonymity in use of the Ning as can be seen in Figure 1.

Figure 1: Students names are blanked out in this forum

Students enrolled in the Ning in large numbers, very soon after the project was announced, yet very few contributed after enrolling. The surveys and informal discussion suggested that the purpose of the Ning was not clearly understood. It was made very clear that from the outset of the project that the Ning was not going to be a venue for discussing course material. However some students appeared to have enrolled in fear that they may miss out on material directly relevant to their studies. Many of the students preferred to lurk, rather than contribute to the online community for fear of missing out.

Finally, times pressures were experienced by both staff and students. Both groups noted how pressed they were for time which meant they didn't contribute as much as they would have liked. Students stated that they had other venues for social interaction so if the Ning was not directly related to their study, it would be dropped. The Ning was not seen as a priority by the students, and they did not have time to devote to it given it was not directly related to their course material and participation in the Ning did not contribute to their final grade.

The pilot trial indicated sufficient engagement to encourage staff to explore further avenues to continue with the program. As a result, staff are currently investigating how to best incorporate the Ning into a suitable subject in the early years of their academic program to encourage further student participation. It is hoped that this will lead to more visible evidence of student membership and engagement.

Conclusions

From the above we can draw several conclusions regarding the use of social media in education.

Social media may well have a place in Education but it needs to be integrated within existing courses. Students already have social networking sites such as Facebook that they use to discuss matters, including study related topics, with their friends. Another site sponsored by instructors with no clear benefit to them is unlikely to be used unless there is some incentive to do so. Such incentives might include assessment of what a student believes to be their best contribution to an ongoing discussion and the best topic initiated for discussion by them.

If there is to be no linkage to assessment items, then the ability to post anonymously, thus limiting the potential level of intimidation should be considered. This would remove a layer of inhibition and perhaps promote more interaction. Conversely, it could encourage unsocial behavior, which is not desired in a closed community.

Social networks used as supplementary learning tools to enhance a community has promise, and we had hopes that the Ning might be used as a vehicle in which students could learn more about their profession. We still believe this to be the case. However, it needs to be used in a more structured way, with improved integration into the students' study programme for this to occur.

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Evaluation of a MOOC pilot: impacts on pedagogical and technical design and dementia education research

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This paper presents the evaluation of the pilot of a Massive Open Online Course (MOOC) called *Understanding Dementia*. The business case identified potential benefits of: ability to deliver high quality expert knowledge about dementia on an international scale; a dataset for dementia research of international perspectives on dementia care; enhanced reputation of the University and providing a pathway to traditional course for non-traditional students. The development team used a design-based research approach guided by the evaluation-research framework for e-learning and the concept of an 'e-learning life cycle' in (Phillips et al. 2012). The paper describes the evaluation-research design and results for the pilot phase. It shows how data analysis from the pilot informed the pedagogical and technical aspects of the learning design for the first full release and the value of a planned, evaluation research approach informing design from pilot to maturity.

Keywords: MOOC pilot; dementia education; evaluation-research design

Background

Relatively new in higher education, the Massive Open Online Course (MOOC) phenomenon has been discussed at conferences, in education literature (Haggard 2013), and online media dedicated to academic concerns (for example, *University World News* (www.universityworldnews.com). MOOCs are considered a new field of teaching endeavor and an emerging field of educational research with potential impact on an education institution and on learners. Burning issues are 'the exploration of a viable business model and the accreditation of MOOC learning' (Haggard 2013, p. 7). Early evidence indicates that poor educational design, technical problems affecting access and/or navigation negatively affect the reputation of the institution associated with a MOOC; good design is critical to minimise risks and achieve benefits at a manageable cost.

There is no financial cost for participating in a MOOC and no limit to the number of enrolments. For the Wicking Dementia Research and Education (Wicking) Centre, the considerable cost of creating the *Understanding Dementia* MOOC was off-set by the expected benefits. The Wicking Centre integrates research and education; its activities are framed by the concept of 'quality of life across the trajectory of dementia.' MOOC-scale delivery of the Centre's expertise was envisaged as an opportunity to provide a high-quality educational experience that would make a difference to people's understanding of dementia, potentially having an impact on decision-making and improving the quality of care. An anticipated research benefit was an international dataset of participant experiences and perspectives on dementia knowledge (King et.al 2013).

The *Understanding Dementia* MOOC is an 11-week course that is open to students internationally. The target audience is anyone with an interest in dementia, whether in a personal or professional capacity, however it is largely designed for those who traditionally do not attend university. Students do not formally enrol at the University of Tasmania; rather they register in the open instance of the university's learning management system. The MOOC is designed to include articulation to the University of Tasmania's new Bachelor of Dementia Care. This paper will set out the methodology for evaluating the *Understanding Dementia* MOOC during the preliminary design phase. It will present the results of the 3-week pilot release in terms of the implications for pedagogical and technical design, as well as reflecting on the benefits of a designed evaluation framework to inform a MOOC approach.

Methodology

The disruptive character of MOOCs, with associated risks and uncertainties, warranted a research-oriented project management approach to ensure a solid evidence base for pedagogical and technical decisions. The *Understanding Dementia* MOOC was developed using a design-based research approach (van den Akker et al. 2006) scaffolded by the (Phillips et al. 2012) Educational Evaluation Research (EER) framework. The research has three broad phases, aligned with the life-cycle of a learning design (Phillips et al. 2012): P1) pilot; P2) full release (revise for quality improvement); P3) mature design (evaluate for impact and effectiveness).

The preliminary learning design was developed within the context of a decision to invest (primarily human) resources to gather and analyse data to underpin each phase of decision-making. The development of the MOOC included three foci of design activity: F1) pedagogical; F2) technical and; F3) dementia research. The pedagogical and technical design process is detailed in (King et al. 2013). The pedagogical design was informed by research into teaching as a design science (Laurillard 2002) and technology-enhanced learning, for example, as Collis (1996) and Herrington et al. (2010). The EER framework was followed to identify research questions appropriate to the stage of the *Understanding Dementia* MOOC's design life cycle, data sources and appropriate methods of analysis for each data set (Phillips et al. 2012). This paper describes the evaluation-research approach for the three foci of design activity, and results for the pilot phase of the MOOC. The data analysis from the pilot informed the pedagogical and technical aspects of the learning design for the first full release and also provided insights into possible data sets for dementia research that might be embedded into the MOOC.

Evaluation-Research Design

The *Understanding Dementia* MOOC took a cohort-centric approach to course structure and design (King et al. 2013). Although the content was structured to be broadly appealing to a general audience, it was considered important, in the baseline period of design, to identify cohort characteristics of relevance to the learning design. Based on the dementia education and research expertise of the Wicking Centre, the MOOC was designed to primarily appeal to care workers in the aged care sector, typically women, aged above 40 or people with a personal interest. Therefore, the design did not presume any level of prior tertiary education or technical proficiency. The 3 week pilot was released in April 2013. Pilot design details are reported in (King et al. 2013).

The pilot was a soft launch with 184 participants: initially academics and students were recruited from the Wicking Centre and two Schools in the Faculty of Health Science; 'word of mouth' and social media generated participants from a diversity of backgrounds Australia-wide. Table 1 summarises the data sets collected during the pilot and the relationship to the research questions and three foci of the design (P: pedagogical, T: technical, D: dementia research). The research questions for the pilot pertained to the pedagogical and technical design of the MOOC, as well as whether participant activity would deliver meaningful data for dementia research.

[1] What is the educational background of participants in the Understanding Dementia MOOC pilot?
[2] What are the motivations and expectations of students undertaking an Understanding Dementia MOOC and the level to which they are met?

[3] What is students' baseline knowledge about dementia (pre-) and increase in knowledge (post-MOOC)?
[4] What are students' experiences and observations of the pilot MOOC design in terms of structure, useability, accessibility, navigation and support?
[5] What data generated by participants in an Understanding Dementia MOOC could be useful to gain an international perspective on the major issues relevant to dementia?

Table 1: Relationship between the data sets, research questions and MOOC design focus

Data Sets [related pilot research question]	P	T	D
Registration (demographics) [1]	x		x
Baseline Survey (educational background; motivation) [1]	x	x	x
Dementia Knowledge Survey (DKAT-2®) (Toye et al. 2007) [3]			x
Early Exit Survey (automated: reasons for exiting; feedback) [4]	x	x	
Feedback Survey (solicited: content; delivery; technical design) [4]	x	x	
Reflective Writing (reflection on and about content) [5]			x
Discussion Fora (multiple fora on range of topics) [5]	x	x	x
Email Feedback (unsolicited) [4]	x	x	x
Verbal feedback (solicited) [4]	x	x	
Analytics (quantitative data generated by MOOC platform)	x	x	x

Pilot data from the *Registration* and *Baseline Survey* was analysed primarily to inform pedagogical and technical design questions for phase (2) full release of the MOOC. The evaluation for this phase was focused on pedagogy and dementia research, directed toward student retention and progression, sourcing data for both education and dementia research. An iterative evaluation-research approach in the revision and growth phase informed the refinement of core material and the development of extension material.

Pilot results: pedagogical design implications

Both qualitative and quantitative pilot data informed our pedagogical design. Data fields in the *Registration* data collection provided quantitative data about the demographic spread of participants. A *Baseline Survey* was incorporated to obtain participants' background education and reasons for undertaking the course, and to enable a more detailed assessment of cohort characteristics. Cultural and/or other demographic data was used for the revision and refinement of material, including technical support. Combined, the two data sets provided qualitative data on, for example, how many participants had previously participated in a MOOC, levels of computer literacy and participant expectations of the *Understanding Dementia* course.

As a general observation, it was clear from *Discussion Forum* data that the majority of participants were comfortable introducing themselves to the other participants and discussing why they were undertaking the course. However, when it came to engagement with the course material via discussion forums and a requirement to contribute via research or personal thoughts on dementia-related questions, numbers dropped dramatically. The *Feedback Survey* at the conclusion of the pilot contained a number of questions relating to discussion forums confirmed that participation was an issue for some: "Maybe it is my age but I am not really comfortable sharing thoughts etc with strangers. Maybe as the course progressed I might feel more comfortable with using this medium." (C1); "I would probably still only use [discussion boards] if I knew my questions were being answered by a subject expert." (C2). (*Comments are anonymous and numbered sequentially*).

In response to resistance to discussion participation in the pilot, an original concept for discussion forums was devised for the full release version, called the 'thought tree.' A thought tree begins with a statement, for example, "quality of life for me means …" and enables participants to contribute their own thoughts in a less threatening space by adding to the major thread or adding threads (branches) of their own. No background knowledge is required. Additionally, 'ask an expert' was introduced into the course design.

The pilot *Feedback Survey* was completed by 28 people, out of the total 128 active participants; it provided the majority of useful information for the learning design of the full release. For example, additional activities and scenarios were included in the full release design, with extra 'hints' and 'feedback' features that appear when selected by participants, in response to comments such as, "I was finding it difficult as there was not much feedback. I thought there would be feedback on our notes that we wrote? I guess you would see an assignment question or essay if you were doing the course proper?" (C3). Another participant stated that they would like, " … more videos of stories from people with dementia, there are some great blog sites that people with dementia participate in and tell exactly how it is for them" (C4). This led to including contributions from both a person with dementia and a family carer of someone with dementia in the full release content. Additionally, "Is there a glossary attached to each unit? Perhaps that could be used in conjunction with the text you present" (C5) prompted the development of a glossary specifically for the *Understanding Dementia* course. The definitions included in the glossary were written to contextualise the terms within this learning environment, rather than being derived from definitions from the Internet.

The expertise of the Wicking Centre in dementia research and education is a key value proposition for participating in the *Understanding Dementia* MOOC. Thus the feedback, "Although labelled with Wicking and University of Tasmania I didn't feel the content demonstrated how these groups were at the forefront of the field" (C6), led us to develop a Profiles page of content developers to explain their association with the Wicking Centre and their professional credentials. Similarly, an introductory course overview page was added in response to, "Maybe have a course overview first so we know what's available and where" (C7).

Unsolicited *Email Feedback* provided insights that influenced subsequent course design. The feedback, "if there was only one question at a time in the windows rather than 3-4 which became a bit overwhelming" (C8) resulted in a design change with the separation of individual questions, such that only one could be dealt with at a time. The suggestion of providing, "more signposting of key issues raised in some of the videos etc, just to scaffold the learner to identify they key messages" (C9) and, "Are you considering placing text within the videos to reinforce key concepts? (C10), led to including a slide after each video clip summarising major points covered.

Pilot results: technical design implications

It became evident during the pilot phase that providing one-on-one *ad hoc* technical feedback was not scalable for a massive cohort. The team therefore devised a self-help discussion forum, as well as online help guides and a 'frequently asked questions' page. The *Feedback Survey* included comments on the course content, aesthetic qualities of layout and styles, audio and video quality, and navigational aspects of the learning environment. The team responded to one comment, "It would be nice to have a recorded video that showed how to move through the main parts of the MOOC" (C11), by designing an orientation module for the course that would precede any content modules. The general layout and important aspects of the learning environment were demonstrated via video screen captures supported with text instructions.

The *Feedback Survey* also provided a range of information relating to technical issues, early withdrawal explanations, feedback, suggestions for improving the course and queries. Insights on technical barriers to accessing the MOOC, such as "I had to pull out of MOOC due to slow connection. Your course was video intensive." (C12) and "Is there any other way I can access the course?" (C12) led to plans for text transcripts and discussion questions in an e-book format. In response to a participant suggestion, "I am finding the information quite passive and serious, and needs to be a bit more interactive to feel more engaged. … Maybe a case study in a cartoon format." (C13), the team developed a series of scenarios in cartoon format, accompanied by hints and feedback. Each of the cartoons relate to a family, 'the MOOC Family' who talk about dementia issues.

Personal Communication with participants produced further informative and useful information that was incorporated into the full release course design. For example, one participant mentioned that they had been given a warning from their network provider that they had reached their download limit. In response to this feedback the default resolution of video clips was lowered to reduce the impact on download capacity. *Discussion Forum* data included a technical forum discussion that provided useful information during the pilot. The MOOC development team endeavoured to deal with each technical issue as it arose. Many bugs relating to configuration issues and design faults in the learning management system were reported. Information about issues that were dealt with and any unresolved issues were forwarded to the platform developers.

Conclusions

The *Understanding Dementia* MOOC was, and is, underpinned and informed by a systematic evaluation research approach over three broad design phases of pilot, full release and mature design (Phillips et al. 2013). Evaluation data informed three foci of design: pedagogical, technical and dementia research. This paper has presented the outcomes of phase 1, pilot MOOC. The pilot enabled evidence-based changes to the technical and pedagogical aspects of the design for phase 2, the 11-week full release MOOC. In particular, solicited data such as *Registration, Baseline Survey* and the *Feedback Survey* provided actionable information to achieve designing for learning needs and expectations of the cohort. It is also clear that the *Discussion Forum* and *Reflective Writing* tasks embedded in the MOOC will provide dementia researchers with a rich data set for investigating international perspectives on dementia.

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Orienting students to online learning: going like a dream or still a nightmare?

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Effectively orienting students to online learning appears to be a vital factor in both their initial engagement and ultimate success in eLearning courses. This paper outlines the approach taken at a private tertiary institution and discusses six months of student feedback about their resulting preparedness for online study and their understanding of the role of the online learning community in supporting the success of their learning journey.

Keywords: Induction, orientation, online, retention, success, learning community, engagement

Introduction

Students have been expected to engage with online learning at tertiary level now for over a decade. Crucial to that engagement is an appropriate orientation or induction to the environment, to the skills they will need, to the support that is available and to their fellow students, not only for the creation of an online community but to hopefully reduce the drop out rate and so improve student retention and success. After ten years, what then have we learned about effective orientation processes and what do they look like?

A quick scan of the literature suggests we have learned a great deal about the components of an effective orientation. The importance of students becoming familiar with the online environment and the interactive tools they will be using in order to overcome anxiety and other technical issues has been discussed by McNikle (1999), Salmon (2000), Brace-Govan, Luxton &Wagstaff, (2001), Bozarth, Chapman & laMonica (2004), Motteram & Foster (2005), Levy (2006), Carruth, Broussard, Waldmeier, Gauethier, & Mixon, (2010) and Jones (2013).

In addition, the link between effective orientation and student retention has been made by Yorke (1999), Nash (2005), Wozniak, Mahony, Pizzica & Koulias, (2007) and Schofield & Sackville (2010), while research on effective initial student engagement with online learning communities, which suggests students need instruction specifically on that aspect has been discussed by Geer (2003), Meyer (2004), and Price, Richardson, & Jelfs, (2007).

So it would appear that the dream online orientation course which would increase student chances of making a good beginning and seeing their studies through to the end would have elements of the following:

- A timely familiarization for students to the technological and information skills they will need to succeed
- An introduction to core study and time management skills for autonomous learning
- An exploration of the academic writing skills and standards that are expected
- A summary of the student support that is available
- Meaningful activities to foster initial engagement and provide early feedback
- Guidelines and opportunities for social (and initial professional) online interaction

Success of the online orientation would be measured by how well students felt prepared for their online courses in terms of academic expectations, their comfort levels with the technology required and familiarity with the online environment they will be working in, and, ultimately, lower attrition rates.

This paper describes the elements of an online orientation "course" offered free to students at a private New Zealand tertiary provider before they commence their early childhood programmes of study. It presents the results of six months of student evaluations of the "course" and discusses the initial findings. It is a work in progress as the effects on student retention are yet to be measured.

The orientation course

"Learning with *NZTC Online"* is a non-credit bearing course within the LMS in which all beginning students are enrolled immediately on acceptance for study at the College. Via a Welcome email, students are provided with their login and password and directed to the site. They have two weeks to a month to complete the course "assessment" and activities, depending on their real course commencement dates. The lecturer of the course monitors their engagement and contacts them via email if they have not appeared online within a week of their welcome (she receives a copy) and again after two weeks of silence. This escalates to a phone call after that period to check all is well if they have still not engaged with the online materials and activities. There is a compulsory "assessment" which encourages students to consider how they will make the most of the online environment, be a "noisy" learner in their courses and requires them to practise and demonstrate a number of the technological skills required in formatting, submitting and later retrieving feedback on their real assessments. The task is marked promptly (although the outcome doesn't get recorded) and returned to them with feedback about the content as well as the presentation and referencing aspects.

The course site itself is arranged in an identical format to their real courses. The initial page contains the course description and learning outcomes, information about the assessment and the content that will be covered. The actual content of this course though, is an introduction to all the features of the LMS that they will be using during their studies. There are communication tool activities to participate in, a guided exploration of the useful information linked to the Homepage and various videos introducing the value and use of discussion forums, the assessment submission process and the support team provided by the College. Student attention is also drawn to the Academic Skills Support part of the site that will guide them in the analysis, formatting and referencing of their "assessment".

Research (such as that by Jeffrey, Milne, Suddaby, & Higgins 2012) confirms the value of early engagement, therefore participation in the activities is expected and tracked. Discussion forum postings in both the Academic forum where they are asked to introduce themselves, and the Support forum (where they can ask any "dumb" questions) are responded to. Students are encouraged to eMessage their lecturer as well as begin reflective tasks in their Journals, take part in quizzes to test their understanding (though again outcomes are not kept) and confirm they can access the linked websites, online texts, PDFs and videos. This ensures all technical ability gaps are addressed before their first real course begins. Their participation on the discussion forums ensures they have experienced the initial stages of joining an online community.

The final task, after submitting and receiving back their assessment with feedback, is to complete the online evaluation of the "course". The data from six months of those evaluations are presented below.

The course evaluations

The questions in the evaluation ask students to report via a Likert Scale based survey on the layout and ease of use of the LMS (*NZTC Online),* their confidence levels with the general tools and features, their confidence with submitting their assessments which must come through the LMS and be returned the same way, and most crucially, their understanding of the importance of participating in the discussion forums, where they can contribute to an online learning community in support of their studies.

The table below presents the responses of 140 students to those questions on the evaluation tool, which were collected in a six month period stretching over 2012/2013.

Table 1: Student evaluation data

Evaluative statement	Strongly agree	Agree	Combined	Neutral	Disagree
The course has given me a good introduction to *NZTC Online*	74%	22%	**96%**	3%	1%
I feel confident navigating around *NZTC Online*	42%	41%	**83%**	15%	2%
I feel confident using the tools and features of *NZTC Online*	45%	41%	**86%**	11%	3%
I feel confident that I will be able to submit future assessment tasks online	67%	29%	**96%**	3%	1%
The course has outlined who to contact with either technical or academic inquiries	69%	22%	**91%**	8%	1%
The course has shown how I can become a more autonomous learner	60%	30%	**90%**	9%	1%
After this course I will definitely refer to the Academic skills section of *NZTC Online* for learner support	70%	25%	**95%**	3%	2%
The course has explained the importance of discussion forums	76%	16%	**92%**	7%	1%
I feel confident that I will be able to post on the discussion board	78%	20%	**98%**	1%	1%
The course has explained the benefits of contributing to the discussion board	84%	14%	**98%**	1%	2%
The course has explained the role of the learning community	78%	19%	**97%**	1%	2%

Discussion

The data appear to confirm the online orientation course as a valuable and confidence building process for the students' learning journey with the College. The vast majority of students agree or strongly agree that the course has given them a good introduction to the LMS tools and features they will encounter in their studies. As the LMS will serve as their "one stop shop" for the theoretical aspect of their programmes, this suggests that they will be able to access the content and supporting readings they will require to sustain their learning

The data also suggest that the majority of students are aware of who they should ask for assistance for both technical support (the IT Helpdesk has reported a drop of two thirds in calls for assistance over this same period) and academic support if that should be required, however, there is evidence to suggest that the course prepares them to be autonomous learners, as 95% were intending to use the self -help Academic Skills support provided online. The practice assessment seems to have given students confidence that they will have no issues with submitting their real assignments through the system and accessing their feedback and ultimate grade.

More importantly, they appear to have recognized the importance of the interactive nature of their studies and the significance of the discussion forum or online community as a valuable aspect to their success. They have been able to practise posting and responding and the lecturer has been modeling the etiquette and tone expected. The foundations of a community of learning have been laid by asking students to share how they came to be studying early childhood and some of their experiences plus encouraging the students to make their own connections by finding out who is likely to be starting with them on the same courses in the near future and, from the detail in their introductions, who happens to be in their general physical location as well.

The evaluations also collect qualitative data in the form of (anonymous) general comments. Those related to the discussion forum specifically appear to confirm the value of the orientation course to the students in introducing them to the interactive and supportive elements provided.

> *"I may be able to communicate with various people who I may not even see during my course of study."*

"I can independently work on my courses with the advantage of also discussing topics with other students in the discussion forums."
"I feel the greatest advantage for me online studies is sharing experiences from online classmates."

The lack of immediacy (the delay in getting a response in an asynchronous environment) though is also frequently commented upon.

As discussed by Schofield & Sackville (2010), induction or orientation should engage students with activities they feel are meaningful to them and provide conditions where they feel welcome and can share expectations. By participating in the orientation course, students are able to practise the technical skills they will require in their online learning environment and as the format mirrors that of the credit-bearing courses to follow, they are able to experience the process of engaging with both the content that will be provided and with their fellow learners. The students' impressions of the online discussion forums appear to confirm they anticipate that aspect of their courses to be worthwhile and that the activities in the orientation have been useful. One often repeated comment on the forum is that students feel they are in a real classroom with a teacher and fellow students, "We just can't see each other."

Conclusion

The orientation course appears to be successfully preparing students for the demands of their online courses at the College. The timing, just before they embark on their programme of study, is an advantage, plus the course remains available to them while they are studying with the College. They have used most if not all of the LMS tools and features they will encounter and have been directed to the self- access Academic Skills site as well as the people they can call on to support their studies. The activities have fostered early engagement with the content and their fellow students and they have experienced the entire assessment submission and return process. More importantly they have connected with fellow students on their learning journey and laid the foundations of a learning community. Research by Jones (2013) suggests that when students are better prepared for their online experience, this flows over into the long term retention rates in their online courses. This however remains to be seen.

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An opportunity to support beginning teachers in the transition from higher education into practice

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This paper describes an approach for higher education institutions to support beginning teachers across the transition from pre-service into the profession. It presents the need for support with evidence of high attrition rates and of the problems faced by teachers when commencing practice. It suggests an approach that uses mobile technology to facilitate communities of practice during higher education that can then support the teachers in their early years of service.

Keywords: teacher education pre-service transition support community-of-practice

Towards beginning teachers helping each other across distances

The initial years after entering the teaching profession are difficult. There are many accounts of both the problems encountered by beginning teachers (Ewing & Manuel, 2005; Hinds, Williamson, & Gardner, 2011) and the high attrition rates observed (Macdonald, 1999; Plunkett & Dyson, 2011). The need to support beginning teachers is typically addressed through school-based induction and mentoring programs (Barrera, Braley, & Slate, 2010; Bickmore & Bickmore, 2010; Ingersoll & Strong, 2011). This paper describes an opportunity for beginning teachers to be further supported by finding ways for these teachers to help each other across the vast distances in Australia. It builds upon existing work utilising this paradigm (Herrington, Herrington, Kervin, & Ferry, 2006; Sim, 2006; Wilkins & Clift, 2007) by recognising the potential of mobile devices and high bandwidth to propose a nationwide, mobile community of practice that is first developed as a local culture within each cohort within each university.

Anecdotal evidence suggests that the need for peer support in the early years of teaching is currently being met in an ad-hoc way through social media such as Facebook groups springing up within each cohort of teachers in institutions. This can be interpreted as students desiring a continuity with the university community and the support that it can provide (Loughran, Brown, & Doecke, 2001). This paper presents a précis of the opportunity for higher education institutions to be involved in the creation of digital communities that provide support across the transition with a benefit to both the profession of teaching (in teacher support and development) and the institution (adding value to degrees in a cost-effective way).

The need for further support

The need to support beginning teachers is well established through the attrition rates observed and numerous qualitative studies cataloguing the problems faced by teachers in their early years. It is well recognised that the early years of teaching are difficult. Early career teacher attrition rates are one measure of the problem, both in Australia and around the world and this appears to be a long-term issue. A Department of Education, Science and Training (DEST) study put the figure as up to 25% of beginning teachers leaving the profession in the first 5 years (DEST 2003). In the USA a study of 10,080 teachers reached the conclusion of a similar figure of 22% (Boser, 2000). Further evidence shows that this applies specifically to primary school teachers in Australia, with an Australian Primary Principals' Association (APPA) study of 1351 beginning teachers concluded that 24% planned to leave the profession within five years (APPA 2006). Whilst attrition is not always a problem, such as the case of the teacher ill-suited to the profession, and whilst it may not be significantly higher than in other professions, it represents a real cost to society, to individuals and to the profession when good teachers are being lost due to inadequate support (Plunkett & Dyson, 2011; Skilbeck & Connell, 2004).

For those who do not leave the teaching profession, commencing teaching practice is difficult. Beginning teachers face many problems: overly high expectations; entry shock; conflict with other staff; discipline and behaviour management; and building a professional identity as a teacher are challenges that all strike at once (Ewing & Manuel, 2005; Murnane, 1991; Northfield & Gunstone, 1997; Sanford, 1988). The two most cited reasons for leaving the profession are rated as: (i) lack of on-the-job support; and (ii) workplace conditions (typified by discipline problems, poor administrative support and poor overall school culture) (Boser, 2000).

The effects of these problems are more visible in two groups in particular, teachers in rural areas and secondary Science, Technology, Engineering and Mathematics (STEM) teachers. It is often discussed that schools in rural areas can be hard to staff (Beutel, Adie, & Hudson, 2011; McKenzie, Kos, Walker, Hong, & Owen, 2008). Whilst attracting and retaining rural teachers is a complex issue (Collins, 1999; Plunkett & Dyson, 2011; Roberts, 2004) one of the issues that is commonly discussed is that of the *isolation* experienced by these teachers due to distance and disconnection (Munsch & Boylan, 2008; Sharplin, 2002). There is also a shortage of STEM teachers with Australia's Office of the Chief Scientist (OCS) enacting policies to try and address the problem that "the pool from which mathematics and science teachers are drawn needs to be broadened" (OCS 2012, p. 28). To characterize this in the discipline of Mathematics, the Australian Mathematical Sciences Institute (AMSI) considers a qualified mathematics teacher to be one who has at least two years of tertiary education in mathematics. By this definition, 40% of Years 7-10 students and 20% of Years 11 and 12 students are being taught mathematics by unqualified teachers, and AMSI links these numbers to the decline in enrolments in high level mathematics in Year 12 (Australian Mathematical Sciences Institute, 2013). Similar figures are obtained in a separate survey by the Australian Council of Deans of Science (Harris & Jensz, 2006) and the claim is further supported by the findings that the incidence of 'out of field' teaching in science and mathematics is higher in Australia than in comparable countries (Marginson, Tytler, Freeman, & Roberts, 2013).

Whilst this short summary cannot do justice to the complex issues in attracting and retaining quality teachers in Australian schools it serves to recognise that: (i) the beginning years of teaching are difficult and that teachers identify lack of support and isolation as causes; and that (ii) there is an ongoing need to support these beginning teachers, and that the need is especially great in the cases of rural and STEM teachers.

The opportunity for higher education institutions

When pre-service study ends and teaching practice begins, much of the university community is lost, particularly the weaker connections formed with the cohort during their years of study. There is potential for universities to provide a means of support that commences in the years of study, and that is aimed at maintaining the continuity across to this new community. The advantage of higher education institutions taking this initiative rather than leaving it to companies such as Facebook, in addition to the benefit of being clear from commercial and social distractions, is that there is potential to integrate the development of the community into the university curriculum, involve profession-specific groups in its development, and to nurture cross-institutional links after study and integrate this into profession-specific support and development. It address the gap shown in a survey of over 4000 primary teachers, of whom only 34% considered "follow-up from your teacher education institution" as a form of support they received, suggesting that 66% felt they received no support whatsoever from their institution after leaving (McKenzie, Rowley, Weldon, & Murphy, 2011).

A model that helps to articulate an approach to this opportunity is that of the *virtual community of practice* (Dubé, Bourhis, & Jacob, 2006; Lave & Wenger, 1998; Wenger, White, & Smith, 2009) in which the teachers in transition represent a group of participants with a commonality of developing first a practice of study and then a practice of teaching. This approach takes existing attempts that had some success with digital communities (Herrington, et al., 2006) and Communities of Practice (CoP) (Sim, 2006) for pre-service teachers and combines them with the technology that has only recently become available. Students increasingly have access to mobile devices with internet with some Australian universities even beginning to distribute them to commencing students (Gosper, Malfroy, & McKenzie, 2013). Another factor adding to the opportunity is that availability of high-speed broadband will only increase with the advent of the National Broadband Network (NBN). Bringing these notions together, we have an opportunity for higher education institutions to provide support for students across the transition through virtual communities of practice that take advantage of mobile technology. This provides the opportunity to develop the community during the years of higher education, and then to use the community to support teachers after the years of service commence. The approach holds benefits for each of the stakeholders of higher education institutions and pre-service teachers.

The teachers in transition

The teachers in transition can be identified as having three phases, in which the first two normally overlap: (i) pre-service preparation; (ii) practical experience; and (iii) the commencement of service. In the first phase (i) the focus is within an institution, within the shared experience of the cohort. In phase (ii) a shift occurs from the student-teacher in a classroom through to the teacher-in-charge and a similar shift occurs in a focus upon institutional goals of study to profession-related goals of development for the sake of improved practice. The third phase (iii) continues in this vein. The opportunity here is to maintain the community that is developed during (i) throughout the shifting changes in needs. Figure 1 depicts the movement from developing a community within a cohort as in this first phase (i) and moving towards a broad profession-wide knowledge-based as in phases (ii) and (iii). The hypothesis is that such an approach can address the key issues of beginning teacher support and isolation across distances using the affordances of mobile technologies, and that a single platform can support the change that takes place during this transition. Evidence of early work that supports this hypothesis can be seen in the work of Wilkins and Clift's (2007) attempt to develop a network of new teachers within the state of Illinois in the United States.

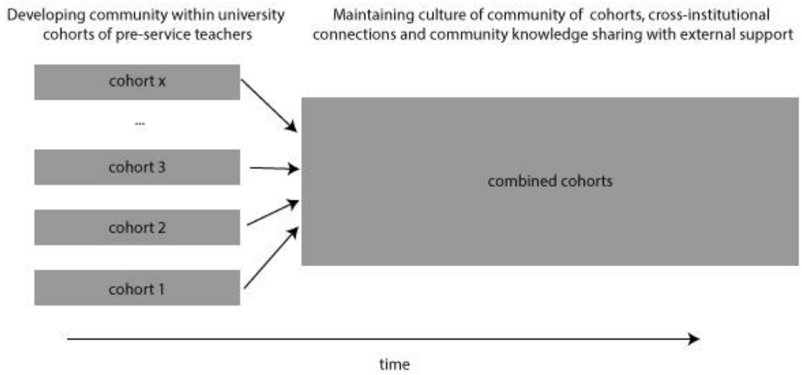

Figure 1: Movement from student communities within cohorts to a professional community of teachers in service within the same mobile platform

The institution

The opportunity for institutions is to further add value to degrees. Higher education is increasingly competitive and it is possible to imagine a future in which, when selecting a degree and institution, students look not only at the quality of the teaching, the practical experience and likelihood of getting a job, but also at the quality of the transition program provided by the institution. Further, the current school-based induction and mentoring programs can be unequal (with different schools having different resources to support teachers) and inaccessible (with teachers more frequently teaching at multiple schools in their first year). A higher education based program is equitable for beginning teachers and can support even those teachers that have short-term contracts – it is a supplement to these induction and mentoring programs rather than a replacement.

Discussion: Designing a platform to support transitions

This paper has presented an opportunity that exists for further supporting teachers during the transition. It has briefly outlined an approach to take advantage of this opportunity. The hypothesis is that: (i) there is a need for further beginning teacher support, particularly for STEM and rural teachers; (ii) that higher education institutions have the opportunity to provide support across the transition; (iii) that mobile technology and high bandwidth further support this opportunity. The paper has sketched a model in which a mobile platform is developed that supports two phases of firstly: (i) support within the university cohort that is integrated into the curriculum; and (ii) support across the profession once teachers begin their practical training and practice.

Research is required to develop these ideas further, examining the way that early career teachers are using existing technology to provide an ad-hoc solution to this need for peer-support (e.g. Facebook), investigation into the design affordances required of the mobile platform proposed here, and finally a pilot with the platform across institutions to establish the utility of the approach.

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Using a collaborative investigation and design strategy to support digital resource development in an online unit of study

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This paper presents the research design and preliminary findings from a study on supporting online students in a collaborative design project. The Collaborative Investigation, Design, Evaluation and Revision (CIDER) approach was used to scaffold the learning activities. CIDER is a learn-technology-by-design approach for collaborative resource design and development. This phase of the study was conducted in a Graduate Certificate in Higher Education unit at an Australian university. Participants, working in small groups, collaboratively developed electronic teaching resources, including a digital story and a website. Data sources for this study include student artefacts, evaluation data, survey data and peer-review feedback from two unit cohorts. The results indicate that geographical proximity was not the key factor in the group's success; rather, a shared disciplinary area was a better indicator of the students' ability to develop an online resource. Moreover, the results indicate that formative evaluation via a peer review process offered a practical way of determining the quality or potential quality of a web-based learning resource before it is published.

Keywords: computer-supported collaborative learning, learning by design, higher education

Introduction

Learn-technology-by-design activities carried out in groups have helped students understand how to use technology in many educational contexts, including higher education (Howard, McGee, Shin, & Shia, 2001; Kali & Ronen-Fuhrmann, 2011). Through a collaborative design approach, students have the opportunity to develop a deeper understanding of both content and technology through the experiences of dialogue and reflection in action (Mishra & Koehler, 2006). Building on existing studies (see, for example, Galstaun, Kennedy-Clark, & Hu, 2011; Hu & Fyfe, 2010; Kennedy-Clark, Galstaun, & Anderson, 2011), the lecturers adopted a collaborative learn-technology-by-design strategy named CIDER (Collaborative Investigation, Design, Evaluation and Revision) in an online unit where groups were to design a web-based teaching resource (Kennedy-Clark, Everett & Wheeler, 2012). The current study was undertaken as part of the redesign of this unit where there was away from an individual approach to learning to a collaborative project-based approach. In this paper we outline the study and present the preliminary findings.

Research design

Context

The context of this study is a core unit on 'Contexts and Issues in Higher Education' in the Graduate Certificate in Higher Education, offered online to staff at Australian Catholic University, and externally. Unit cohorts are small, with enrolments from staff employed across the University's six campuses in Queensland, New South Wales, Victoria and the ACT and a limited number of enrolments from staff at related higher education institutions, such as theological colleges. The study is part of the curriculum redesign of the 'Contexts' unit which was undertaken to ensure the issue of student diversity (for example, strategies for students from low socio-economic backgrounds, or first-in-family, or mature-aged students) was included. The unit had previously been delivered in the form of readings and online discussion, providing large 'chunks' of information with little consideration given to how learners will actually process this information (O'Donnell et al., 2006). Feedback on the unit of study was that there was a need to redesign the unit for pedagogical quality rather than the supply of information alone.

In light of this feedback, the authors adopted a learn-technology-by-collaborative-design approach, working in conjunction with colleagues at the University of Sydney where this approach has been embedded in the standalone ICT in Education units of study (Galstaun et al. 2011). The 'Contexts' unit was divided into three modules: a module on ICT in Education that provided the background and practical skills for using ICT in education, a module on university policies, and a module on diversity. The focus of the unit was to support the collaborative design and development of a digital resource (a website) to provide colleagues with learning and teaching information for an area of diversity. Teaching staff were available online for weekly 'sync' sessions using web conferencing software (Adobe Connect). Students were able to join these sessions to discuss issues raised in the weekly notes and readings as well as to discuss the collaborative process and assigned tasks. Thus, the focus shifted from a passive approach of transmission of information to the incorporation of active learning activities via the adoption of a learn-by-design approach.

The CIDER Model

Kali and Ronen-Fuhrmann (2011) outline two approaches to structuring learn-by-design activities. The first approach is an open-ended reflective approach where lectures and tutorials are dedicated to students' working on their design projects, providing feedback to their peers, and refining their design artefact based on peers' and instructor's input. The second approach, which is more structured, centres on the use of a design scaffold, such as the ADDIE model (analyse, design, develop, implement, evaluate) (Dick, Carey, & Carey, 2001). More recently, there has been a move towards synthesising these two approaches to provide the structure of a model or design scaffold with the openness of reflective practitioners and the precision of peer review and support (Barab, 2004; Kali & Ronen-Fuhrmann, 2011). The CIDER model melds these two approaches. The CIDER model is a five-stage model that we used to scaffold a learn-by-design task. The first stage is *Collaboration,* which is the establishment of the collaborative team (e.g. groups, dyads). The second phase is *Investigation*, which a collaborative investigation of the task and the development of an agreed project plan that identifies group member roles and responsibilities. The third stage is *Development*, which is the development of a prototype or draft artefact – this may be complete or partially complete. The fourth stage is *Evaluation*, which is a scaffolded peer review and evaluation. The fifth stage is *Revision*, which is the reflection, response and revision of the final product.

In our study, emphasis was placed on the use of peer evaluation. The *Evaluation* stage enables students to receive formative feedback form peers prior to the development of the final artefact. A number of studies (for example Budge, Beale & Lynas, 2013; and Ng, 2013) have found peer evaluation to be an integral part of the design process. In our earlier research (Anderson, Kennedy-Clark & Galstaun, 2012), students in a collaborative web design project used video feedback in reciprocal critiques of the website designs of their peers. Hu et al. (2010) found that as students became too familiar with their own products, they were unable to detect the inadequacies of their design. In both these studies, the researchers observed that the feedback obtained from peer assessment helped students to modify their design, and argued that this formative evaluation offered a practical way of determining the quality or potential quality of a newly developed web-based learning resource before it was implemented in the classroom.

Collaborative design task

The students were assigned to groups according to the area of student diversity they 'voted' for via the Learning

Management System (LMS). Once all students had made their selection, the lecturers introduced the group members to each other via email, and this became an important channel for group activities. Students had to submit three assessment tasks during the unit, the first being the collaborative design plan for the final assessment, a collaboratively developed website on teaching strategies that account for student diversity. The purpose of the project plan was to enable students to identify their roles, area of diversity, and the desired website 'look and feel', and the plan was shared on the LMS for group use and lecturer feedback. Since the students were not, in many cases, located on the same campus, much of the design work was remote, and scaffolds were provided for tasks to guide the collaboration and the design. The second assessment was a 'draft' website that was evaluated by peers: the peer evaluation was formative, and was not weighted. Each group reviewed two draft websites: the areas for the review were scaffolded, and used the same criteria as the final assessment rubric. The reviews were anonymised by being forwarded via the lecturers to each group. The third assignment, the final published website, reflected the elements of the peer evaluation which the group had responded to in revising their site. These multiple stages in the product development meant that in the final rubric, there were three columns: the peer evaluation, the group's response, and feedback from the teaching team.

Data Collection and Analysis

The data reported on in this paper represents two iterations of data collection from an ongoing study in learning-by-collaborative design that is using a design-based research approach (Collins, Joseph, & Bielaczyc, 2004; Reeves, Herrington, & Oliver, 2005). A mixed-method approach was used, with data sources including student design plans, student evaluation forms and responses, the final website design, and student feedback.

Results

The final digital resource submissions covered a range of support strategies for areas of diversity in higher education, such as international students, mature-age students and indigenous students. The content and support strategies were adapted to specific contexts (e.g. faculty or location). There was considerable variation in the resources, a couple included videos made by the students whilst other included links to YouTube or embedded Prezis, some relied on visual representations, such as charts, whilst others relied more heavily on text. All of the groups achieved the specified outcomes for the project.

Preliminary results from the first two cohorts of this unit (Groups 1 and 2) provide some indications on the success or otherwise of the use of the CIDER model in an online setting. We determined that measures of success could include the degree of collaboration, quality and use of peer feedback, and whether the published websites were fit for use. One indication of successful collaboration in the design task was the submission of the final product. Although a deadline was suggested, the dates that each group managed to submit their draft for peer review varied widely (Figure 2). Where group members had more characteristics in common, and particularly when dyad members were from the same faculty, their submission was more timely. (The small cohort of Group 2 had different deadlines in a subsequent semester.) Peer review feedback also varied, ranging from simply counting the presence of an element in the rubric to a functional evaluation of its fitness-for-use, and this range was demonstrated by the text choices made.

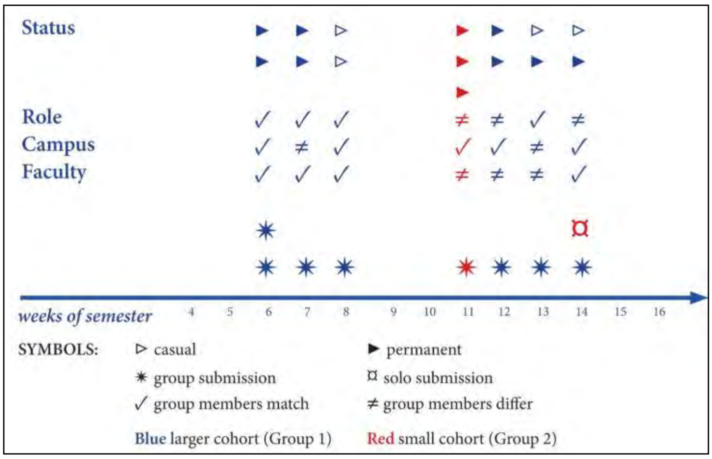

Figure 2. Time (week) when draft was submitted for peer review

Student feedback in the course evaluations indicated that the students liked the challenge of the course and the clear organisation of the project. Students also indicated that the accompanying lecture notes and recorded sessions were useful resources. However, feedback indicated that the actual workload of building a website resource was considerable and that face-to-face technical support would be helpful.

Conclusions

In this paper, the preliminary findings of the re-design of an online unit were provided. The re-design focused on a move away from an individual content driven approach to a web-design project which was underpinned by a collaborative design strategy. While student feedback on their experience in this unit was very positive, the lecturers' reflections were mixed. The teaching team were pleased with the motivation and commitment displayed by the dyads/groups, and the depth of content they researched and presented: but we acknowledge that a greater improvement in technical skills and design literacy might have been achieved with one or more additional drafts or opportunities for peer or lecturer review.

The use of peer feedback provided a valuable step in the revision of the final websites and provided students with clear strategies to revise their designs that were not influenced solely by the perspectives of the teaching team. Subsequent offerings of the unit will encourage students to share draft artefacts or parts of the design more regularly with a greater range of unit colleagues, using conferencing and screen sharing to overcome the restrictions of practising collaborative learning by design in an online setting.

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Emerging teachers' conceptions about their current use of ICT in vocational education

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This article presents emerging results from an ongoing phenomenographic study that examines teachers' conceptions of ICT-enhanced teaching and learning in vocational education. Twenty three teachers from three Technical and Further Education (TAFE) institutions participated in semi-structured in-depth interviews about the role of ICT in their teaching and profession. The emerging findings reveal that vocational education teachers consider ICT use for teaching vocational courses in five different ways. Specifically, they saw the use of ICT for teaching: 1) as a response to external expectations; 2) as a means to access information and resources; 3) as a delivery tool; 4) as media to support active learning; and 5) as an environment for preparing students for their chosen profession. While some of these findings are in line with those of similar phenomenographic studies in higher and tertiary education, conceptions a) and e) tend to be more distinct in vocational education settings.

Keywords: ICT-enhanced teaching, vocational education, teacher conceptions, TAFE.

Introduction and background

How do teachers' conceive the role of Information and Communication Technologies (ICT) in professional and vocational education? How do they use these technologies to support their teaching and students' learning? With the growing concerns about the quality of ICT-enhanced learning and teaching in tertiary education, there has been an increasing interest in how teachers conceive the role of ICT in their teaching and students' learning (Ellis, Hughes, Weyers, & Riding, 2009; González, 2010; Roberts, 2003). Looking to the past, some studies have found that what teachers say about teaching and what they do in classrooms are not necessary the same (Kane, Sandretto, & Heath, 2002), nevertheless other studies have shown that the conceptions that teachers hold about learning technology tend to be strongly associated with how they approach the design of ICT-enhanced courses and how they go about using ICT in their teaching practice (Ellis et al. 2009; Gonzalez, 2009). In short, what teachers believe about the use of ICT in their teaching does matter to the kinds of learning environments and experiences they will eventually design for students.

Research studies in this area has investigated various forms of ICT-enhanced learning in higher education included web-based learning, online learning, eLearning and blended learning. In this line, the first study conducted by Roberts (2003) in a Scottish university, revealed three teachers' conceptions of teaching using the Web: 1) as a source of subject information; 2) for individual and independent self-paced learning; and 3) for group analysis/interaction, decision-making and dialogue. These findings have been extended in a more recent study conducted by González (2009) in an Australian university. He identified three slightly different conceptions of Web use for teaching online: a) for individual access to learning materials and information, and for individual assessment; b) for learning-related communication; and c) as a medium for networked learning. Gonzalez (2009) argued that what he identified as "networked learning" with a distinct focus on knowledge building had not been identified in similar study undertaken by Roberts (2003). Previous studies investigating teachers' conceptions of ICT-enhanced teaching generally found similar conceptions falling into two broad categories: more “fragmented” or “less complete” which focus on ICT as a tool to enhance access and delivery; and more “cohesive” or “complete ” which focus on ICT as a way to facilitate students’ engagement with learning (Ellis et al, 2009, Gonzalez, 2009). While studies generally share some broad common characteristics of teachers’ conceptions of ICT in teaching new studies often bring to light new distinct insights into this phenomenon. Overall, researchers argue that teachers’ conceptions of ICT cannot be understood in isolation from context and they therefore stress the need to take into account institutional influences, curriculum, subject, students’ profiles and other contextual elements (González, 2009; Lindblom-Ylänne, Trigwell, Nevgi, & Ashwin, 2006; Trigwell & Prosser, 1996). Almost all studies on teachers conceptions of ICT in tertiary education have been conducted in university settings (González, 2010; Prosser, Trigwell, & Taylor, 1994), and very little is known about how teachers perceive ICT in vocational teaching and learning environments. Only very recently, a questionnaire based phenomenographic study conducted by Bliuc et al. (2012) investigated teachers’ conceptions of blended learning in vocational education. It identified five conceptions: 1) blended learning to empower students for lifelong learning; 2) blended learning for students’ needs and learning goals; 3) blended learning to improve students’ access to learning and meet their practical needs; 4) blended learning as an aggregation of face-to-face, online and other types of technologically driven delivery; and 5) blended learning as the use of technological teaching tools. These findings reveal potentially rather different views of ICT-enhanced teaching in vocational education, such as empowering students for lifelong learning or providing students with “gap training” that addresses their individual needs. However, no in-depth interview-based study has been conducted to investigate these teachers’ beliefs about the use of ICT in vocational education. In order to fill this void, in this study the researchers aim to investigate teachers’ conceptions of ICT-enhanced teaching in vocational education. Our research question is: What does ICT-enhanced teaching mean to TAFE teachers?

Methodology and study design

This study used a phenomenographic research methodology (Marton, 1981; Marton, Watkins, & Tang, 1997). Phenomenography aims to identify qualitatively different ways in which people understand or experience particular phenomenon, such as teaching, blended learning or teaching online. In this study, the focus was TAFE teachers’ conceptions of the use of ICT in vocational education. A semi-structured phenomenographic interviewing technique was used to collect data. The aim of the interviews was to explore TAFE teachers’ awareness about using ICT in their teaching. The interviews started with broad “what” type of questions, such as: “What does ICT in teaching mean to you?” Followed by further probing to establish an in-depth understanding of how participants perceived and experienced the use of ICT in their teaching. The interviews ended with a request to see some examples of their ICT-enhanced teaching resources. All interviews lasted between forty to sixty minutes. In total, 23 participants from three TAFE institutions in NSW, a main Australian vocational provider, were interviewed. In order to achieve a considerable variation in teachers’ experiences, participants were selected from different specializations (engineering, arts, business, accounting, etc.), employment levels, age groups, gender, and years of ICT use for teaching. The results presented in this paper are based on the initial analysis of ten transcripts (Table 1).

Table 1: Participants demographic information

Teacher ID	*Institution ID*	*Gender*	*Discipline*	*Employment level*	*Teaching with ICT mode*	*Experience of teaching with ICT*
P01	T3	Male	ICT	Full time	Blended	16 - 20 years
P02	T2	Female	ICT	Full time	Blended	16 - 20 years
P03	T3	Male	ICT	Full time	Face-to-face, blended	21 or more years
P04	T3	Female	Accounting	Full time	Face-to-face, blended, online	11 - 15 years
P05	T1	Male	Mechanical Engg.	Part time	Face-to-face	11 - 15 years
P06	T1	Female	Accounting	Full time	Face-to-face	0 - 5 years
P07	T1	Male	Finance	Full time	Blended	11 - 15 years
P08	T2	Female	Community service	Full time	Face-to-face	6 - 10 years
P09	T2	Male	Business studies	Full time	Face-to-face	0 - 5 years
P10	T2	Male	Event management	Part time	Face-to-face	0 - 5 years

Data analysis and findings

Data analysis followed the procedure suggested by Sjöström & Dahlgren (2002) which was originally developed and employed for analysing pheomenographic interviews in professional education, namely, nursing research.

Initially, all interviews were transcribed, and the transcripts were read several times in order to become familiar with their content. After, a more in-depth reading was done to identify those participants' responses that were related to particular research questions. During the next reading, the central elements of the participants' answers were identified and labelled. Then, similar answers were classified into preliminary groups. These groups were reviewed several times checking whether or not responses with similar meaning appeared under more than one heading. This analysis resulted in an initial list of the categories of descriptions. Before presenting the outcomes, the ten transcripts were reread to confirm that the preliminary categories accurately and comprehensively represented the experiences of the teachers interviewed. Five qualitatively different categories of conceptions have emerged through this process.

Category A: ICT is used to meet external expectations
This conception represents the TAFE teachers' view of ICT use in teaching as meeting external expectations. These expectations include several distinct aspects. First, teachers experience both organizational pressure and departmental requirements to use ICT, for example, when advised to do so by a head teacher. Second, teachers' decisions to use ICT sometimes derive from their own interpretation of what is expected from them as teachers. For example, some participants noted that technology had reached many teachers already and they did not want to lag behind in this "digital revolution". Third, teachers are aware of students' interests in ICT and their expectations that teachers would be "technologically literate". Overall, in this conception, the central purpose for using ICT is less related to the intrinsic teaching or learning goals, but to the external expectations and demands to adopt ICT-enhanced teaching. The participants did not see much difference between teaching without ICT and with ICT.

> "When you get up there and you're just putting up PowerPoint slides or something along those lines, there's no difference in the technology between that and putting up overhead slides and writing things on the board. There's nothing new, it's just a different way of doing the same thing" (P03-T3).

Category B: ICT is used to gain access to information and resources
In this conception, ICT is a method and tool for obtaining information for teaching. Teachers consider technology as a resource bank. They access information needed for their teaching by researching the Internet. They use ICT to update their knowledge, add new content to their courses and prepare their notes for students. ICT is considered an instrument for accessing resources and preparing for teaching, rather than a tool which is used directly in the teaching and learning process.

> "I can connect to the net and download various websites or play short video clips if I so choose. So I guess my view is, these are simply electronic tools" (P09-T2).

Category C: ICT is used as a delivery tool
In this conception, teachers consider ICT as a delivery tool for their teaching. This category includes several distinct methods of ICT use. First, ICT can be used to support face-to-face instruction. For example, teachers saw ICT as a tool for sharing notes and other resources with students and submitting assignments. Second, ICT can be used as an integrated course delivery platform. For example, TAFE teachers use Moodle for supporting their teaching. Third, ICT is seen as a tool to enhance classroom presentations, for example teachers could use PowerPoint presentations and interactive whiteboards, and make demonstrations using simulation software. Some teachers also saw ICT as an alternative delivery system, for example, some TAFE teachers occasionally presented their subject's content online. Overall, in this conception, ICT is a means to support and enhance teachers' instructional activities and effective course delivery:

> "Before (using ICT), I print out the financial reports of each public company and try to explain them but it was hard to follow. But if they see that on the screen, it's more broadened. They can see everything and they can see where I'm at, where I'm going. So it's much understanding for students as well and much easier for me as well" (P06-T1).

Category D: ICT is used as media for active learning
In this category, the primary intention of using ICT is to create active learning opportunities. ICT is considered an interactive media for engaging students in learning in a myriad of ways, such as group discussion, brainstorming, various project-based tasks, and analysis different software based tasks. This conception not only emphasises the technology and teaching, but also the active learning. Therefore, the focus of teaching shifts from the provision of information and delivery to the encouragement of students to get involved in their learning and the facilitation of the learning process. The main intention here is to create an environment where students are involved in a more independent, self-paced and active learning and construction of their understanding.

> "I like to get the students to go out and explore and find information for themselves, so having computer technology available in the classroom, or available at home enables them to find the

information or find a lot of information, and then my job is to help them filter that information and assess that information, put it all together, bring it together in a classroom environment and use that to teach each other" (P01-T3).

Category E: ICT is an environment for preparing students for future profession
In this conception, technologies are primarily considered as a medium through which students could develop knowledge and skills for a future career. One of the roles of ICT use in teaching is to make sure that students are prepared to participate in the constantly changing workplace of the future. ICT is seen as a means to assist students in accessing up-to-date information, connecting them with the professional world of the future. Here, similarly to Category D, the teachers are primarily facilitators of students' learning. Their focus is on creating teaching and learning environments where students can develop their understanding and skills for their future profession. This conception differs from Category D, as it emphasizes not only active students' roles, but networking, collaboration and interaction with a particular focus on professional competences needed for a future career in industry.

"So it's also part for us to make sure that our students are ready for the technology when they go out in the workforce. We need to prepare them for that as well. So I think it's just a different strategy, a different teaching strategy really making sure that you are addressing the needs that they have" (P08-T2).

Discussion and conclusions

Some results from this analysis support previous research findings of teachers' conceptions of various kinds of ICT-enhanced teaching and learning, such as blended learning, e-learning, web learning and online learning (Ellis, et al., 2009; González, 2009, 2010; Roberts, 2003). For example, Category B (ICT is used to gain access to information) is in line with the previous finding of Roberts (2003) where some teachers conceived the web as a source of information. Category C (ICT is used as a delivery tool) is similar to the findings by Ellis et al. (2009) where some teachers conceived of learning technologies as tools for information delivery. Similarly, comparable conceptions to Category D (ICT is used for active learning) have been found in studies by Ellis et al. (2009) and González (2010). This study, however, reveals two different conceptions of current ICT use by vocational teachers. Category A (ICT is used to meet external expectations) has not been found in previous phenomenographic studies. Category E (ICT helps students preparing for future profession) shares some similarities with the conceptions of learning technology as "ways of building knowledge" (Ellis et al., 2009; González, 2010) found in higher education. However, university teachers' conceptions primarily focused on students' academic development and construction of deep authentic understanding. In contrast, vocational teachers' conceptions of ICT use have a strong focus on practical knowledge and skills relevant to future workplace. Overall, the above findings provide initial knowledge about how vocational teachers understand ICT use in their teaching. These findings, in line with some previous studies of vocational education (Lucas, Spencer, & Claxton, 2012), show that improving practical knowledge and skills through the use of blended learning and ICT for the prospective profession is one of distinct concerns of vocational pedagogy and an important area for future research on ICT in vocational education.

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ELECTRIC DREAMS
30th ascilite Conference, 1-4 December 2013
Macquarie University, Sydney

“Hearing the thoughts of others”: Student voices and affordances of podcasting for learning

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This paper reports on a qualitative case study exploring the affordances of student-generated podcasts. Findings from online focus groups with students indicated that podcasting was useful for building technological skills and confidence, supporting multimodal ways of learning that value relational connections, student perspectives and collaborative reflection. Students valued technical support when podcasting for the first time. In terms of the conference theme, we imagine a future where teachers integrate digital literacies and pedagogies by experimenting with practice, involving students actively, and employing learning networks for sustainable support.

Keywords: teacher education, podcast, student voice, online learning, tertiary education

Introduction: Student-Generated Podcasting in a Tertiary Context

This paper reports on a case study of student-generated podcasts in the context of a semester long asynchronous online initial teacher education class. It is increasingly popular for tertiary learners to access podcasts in order to listen to pre-recorded lectures, or supplementary materials (Lonn & Teasley, 2009). However, Selwyn (2007) reminds us, podcasting to transmit information to students does not optimise Web2.0 capability by supporting user creation, collaboration and communication of students’ ideas. The learning potential is greater still when students use podcasting to speak and listen to each other (Anzai, 2009).

Podcasting to learn is valuable for supporting learner flexibility and control, motivation and engagement, cognition and learning, and for offering novel opportunities for teaching (Dale & Povey, 2009; Riddle, 2010). Students enjoy podcasts for their novelty value and the break they represent from text-based study. Importantly, students are motivated by the opportunity to express themselves for a genuine audience, and by receiving feedback from listeners (Dlott, 2007; King & Gura, 2007). Creating and sharing podcasts can enhance reflection as learners reconsider and modify their ideas based on feedback from others, illustrating its formative potential (Campbell, 2005). This is particularly powerful when podcasting is episodic, with reflection occurring at various points in the learning process (Schmit, 2007). Podcasting suits diverse students, and caters for differentiated learning preferences, such as aural learners and those who need to move around (Lum, 2006). Students develop problem solving and technical skills associated with the recording, editing and publishing of podcasts throughout this process (McLean & White, 2009). They learn communication and presentation skills (Nicholls, 2008) and also find their voice in terms of efficacy, democracy and empowerment (Beilke, Stuve, & Williams-Hawkins, 2008).

The Research Context

Professional Practice and Inquiry is a second year undergraduate course within the Bachelor of Teaching degree for students studying online. Typically, the students are mature adults, geographically dispersed, juggling work and family commitments with flexible full-time study via Moodle and on-campus block meetings. The course is designed to provide students with an overview of educational psychology as a foundation for effective pedagogy. Students engage with key learning theories and themes of motivation, management, and assessment as integral to effective pedagogy. In this study, the lecturer used podcasting to enhance student reflection and the sharing of their emerging understandings as teachers. The process of student-generated podcasts is consistent with and informed by constructivist and sociocultural views of learning where students are active participants in their learning (Bell, 2011). Having taught the course for several years, and having experimented with podcasting elsewhere, the lecturer had four pedagogical goals for the podcasting task: to acknowledge student voice through a podcast of their reflections, complement written modes of student learning with opportunities for oral expression, complement traditional summative assessment with a more participative approach, and empower students to undertake an active approach to learning and teaching through information and communication technology (ICT).

The open source programme, Audacity, was used for course participants to produce their podcasts, which they then shared with the class via Moodle. Each staff member (the lecturer and two tutors) initially generated a podcast in order to model the process for the students, and guide them to produce two podcast episodes (three minutes each) for the purpose of "podcast-mediated reflective learning" (Ng'ambi, 2008, p.133). The first episode related to students' observations of assessment approaches during a six-week teaching practicum, and the second episode entailed a synthesis of the students' emergent teaching philosophy. The student-generated podcasts were unassessed but compulsory tasks. The 80 students shared their podcast episodes with their discussion groups in Moodle. Staff and students received technical support from the university e-learning staff. Students were provided with detailed instructions and an online help forum within Moodle. This paper reports on student perspectives of their podcasting experience in the course. The general study rationale and perspectives from staff have previously been reported elsewhere (Forbes, 2011; Forbes, Khoo & Johnson, 2012).

Research Design

The overall research question guiding the study was "To what extent could student generated podcasting afford the incorporation of student voice and support for learning?" A qualitative, interpretive methodology framed the collection and analysis of the data, which were gathered from the end of course evaluation and an online focus group (Mann & Stewart, 2000, 2004; Williams & Robson, 2004). The online focus group operated as a forum in a separate area of the Moodle class. Students entered the focus group space voluntarily to discuss and give feedback on the podcasting activities (Forbes, 2012). Forty three students (57%) in the course responded to the course evaluation while 17 students participated in the online focus group discussions. A constant comparison approach to data analysis identified emergent themes (Lincoln & Guba, 1985). Findings from the study are reported next followed by a discussion focusing on the pedagogical implications as opposed to measures of student learning outcomes. This study received formal university-level human research ethics approval and all participants participated on a strictly voluntary basis.

Findings

Three key themes emerged from the data: 1) podcasting afforded students opportunities to enhance their skills and confidence such that they were able to extend these skills to the use of new technologies, 2) podcasting offered transformative possibilities for learning, and, 3) podcasting can be technically challenging for some students but this is mitigated by the availability of technical support. These themes are explained and illustrated with representative student quotes.

1. Developing confidence and skills

Most students initially believed podcasting would be difficult, and felt daunted as they were not 'techies':

> I am nervy about the podcasting: I am not comfortable with the sound of my voice, I do not even like listening to my answer machine. (Student 1)

Students, however, appreciated that the dispositions developed through podcasting might in turn influence their willingness to explore new teaching possibilities involving a range of technologies in their own classrooms:

> [Podcasting is] a valuable communicative tool, which I will certainly use in my own classroom one day with any number of curriculum areas- make plays, interviews, poetry, story telling, social studies or technology research... (Student 2)

Students resorted to strategies such as scripting their ideas, typing up notes and having practice trial recordings as part of their podcasting experience whilst others found listening to the lecturer's podcast helpful for modeling expectations:

> I did have a lot of notes to read from, next time I will probably try to it in a more relaxed way, with slightly less notes. (Student 3)

> I found it was a great way to understand the task a little better and make sure I was on the right track. The lecturer's podcasts made me feel more at ease… they were not rehearsed. (Student 4)

After the initial podcasting experience, the opportunity to create a second episode empowered students to improve upon their earlier attempts. The first experience prepared them for listening to their own voice, and consequently they became more relaxed and able to enjoy the second experience:

> Once it is set up it is no problem at all, it is so easy to use and I found your confidence grows second time around. First time round I don't know how many recordings I made before I posted, this time round posted on my first attempt. (Student 5)

2. Transforming learning possibilities

The podcasting tasks enriched students' online learning experiences in three ways – it humanized the learning experience, it incorporated a multimodal dimension to the typically text-based learning environment, and it fostered student collaboration and interaction.

Podcasting humanized the online learning environment by allowing students to share the emotions and tones embedded within one another's voices. This enhanced the sense of community and fostered engagement with one another at a personal level:

> One thing that I enjoyed is that in the podcasts you can hear emotion, judge tone and understand the message from the other easier than a written article. It would be a lot harder to misinterpret a podcast than a posting. (Student 1)

Podcasting enhanced the multimodal dimensions of learning online, that is, listening to one another complemented communication via reading/writing in online discussion forums. One student indicated that the act of recording and producing podcasts helped her to evaluate and refine her thinking:

> Hearing rather than just reading gave a different element to learning, it made the paper more engaging as it was different than that of another Word document. I would definitely use it in the classroom. I can see great value in using podcasting in the classroom, especially for students who do not always show success with pen and paper activities…opens the door to many new and different options. (Student 6)

Students mentioned the value of listening to peers' podcasts as enabling the sharing of ideas, enhancing understanding of content and triggering further thinking and reflection:

> I really liked listening to other podcasts because I was able to pick up some really good ideas that are being used in the classroom in relation to assessment. (Student 7)

3. Positive experiences with podcasting were conditional on good technical support

Students appreciated technical support offered in terms of short video tutorials and clear instructions to clarify the podcasting process and troubleshoot common issues faced:

> Being such a techo-phobe I was not looking forward to doing this podcast at all… However, I was delightfully surprised at how simple it was to construct and record a podcast (whoever wrote the step by step instructions about downloading etc. deserves a chocolate fish!). (Student 8)

Discussion and implications

This study sought to understand how student-generated podcasts could enhance student voice and support for learning in an online initial teacher education course. The findings indicated that student teachers developed technical skills and the confidence to try out new technologies. They experienced multimodal learning, with enhanced interpersonal relations, opportunities for reflection and formative interaction. While students are initially reliant on direct technical support, the skills and growing confidence gained from podcasting enable them to reach out to other resources for trouble-shooting assistance, so that experimentation with new pedagogies and technologies are supported. The following issues and implications emerge from this analysis of student perspectives on podcasting in professional practice:

Embedding purposeful digital challenges in learning contexts

Students thought that the podcasting reflective learning activity prompted them to extend their technical skills, take risks and 'have a go' at something they might otherwise not have tried. In the process, they developed skills and confidence and articulated their willingness to problem solve with new technologies. It is hoped that these dispositions might be extended to experimenting with other ICTs in the classroom, as teachers develop digital literacy and are able to seek out and use other available tools for pedagogical purposes.

Pedagogical design: multimodal, collaborative, formative

Our study indicates that student-generated podcasting can prompt interpersonal engagement, as students (and staff) speak and listen, and give and receive feedback. Since online study can be isolating, use of multimedia communication modes can foster students' sense of a learning community. Podcasting has a humanizing effect as students, empowered to express their ideas verbally for an authentic audience, could mutually listen to their colleagues' voices for feedback. The opportunity to produce more than one podcast episode enabled further reflection, revision and refinement of ideas as part of a formative approach. We are encouraged that student teachers promptly see the relevance of student-generated podcasts for their own classrooms, and are hopeful that elements such as multimodal, collaborative and formative pedagogies will perpetuate future classroom practice.

Sustainability of technical support

The positive experiences of podcasting were predicated on robust technical support at all stages of the process. However, we are mindful that a classroom teacher will not usually have technicians standing by to help when technical hitches occur. The pro-active use of resources derived from online support sources is transferable to the classroom, and teachers can be encouraged to make use of wider networks (including Personal Learning Networks) to problem solve through technical issues.

In concluding, our exploration of student voice and affordances of podcasting has served to remind us that student perspectives are a useful guide for future directions in teaching and learning. As we look to the future, we are hopeful that beginning teachers will have confidence to experiment with technologies and pedagogies, actively involving pupils, and building learning networks for sustainable support of their adventures in teaching and learning.

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Mobile Learning at Charles Sturt University: Lessons learned from university-wide iPad trials in 2012

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The mLearn Project at Charles Sturt University (CSU) started in 2011 as an initiative to explore mobile learning and its application and potential for the institution. This paper provides a meta-perspective of one particular aspect of the project, a series of university-wide device trials, and describes what took place, the initial findings, discussions related to mobile and the key recommendations from the project. The project has provided a way for the university to explore new technology within its specific and unique learning and teaching contexts. It has provided real world experiences from which to learn and through exploration a better understanding of our present has been reached. This paper is an attempt to share the examples and experiences and provide a basis to imagine our future direction.

Keywords: mobile learning, institutional initiative, technology project, innovation, iPad

Introduction and context

In 2011 Charles Sturt University (CSU) established the mLearn project to investigate the potential for mobile technology to be used in all our learning and teaching contexts - both distance, on-campus and in practice-based settings.

The aim of the project was exploratory, seeking to understand what is possible today so that we can start to imagine the future - one might call it mobile dreaming. Large-scale adoption of mobile technology is still very new in the education sector, so the goal of the project has been to gain knowledge, understanding and real world experience. This has been achieved by conducting device trials with our students, our staff and infrastructure.

The trials have been set up in consultation with the Learning and Teaching Sub-Deans, academics and educational designers who set up the parameters for each trial in consultation with a central project team. The central project team consisted of the first author as the project lead, programming staff and representatives from key divisional areas. The project sponsor, who is the second author, facilitated the work of the Steering Committee that has representation from key divisional staff as well as from the faculties. The mLearn project runs from within the Division of Student Learning of which the authors are members. As leaders and immersed contributors to the project, the authors have a unique opportunity to develop a meta-perspective of the trials and provide a ‘big picture’ to show connections and broad implications. This meta-perspective covers a number of trials, in multiple faculties and in multiple disciplines and is different from largely singular or uni-discipline trials and interventions such as those recently reported by Albion et al. (2012); Goldacre (2012); Steel (2012); Timoko (2012); Tutty (2012); and Watanabe (2012)

The project’s design and development has been greatly influenced by the work overseas at Abilene Christian University in their *ACU Connected* project and the *iMedEd* initiative at the University of California Irvine as well as local initiatives shared through Ascilite from Bond University (Brand, 2011) and The Chinese University of Hong Kong (Lam, 2011). Essential to the project was to build on this prior work and develop of unique and contextual understanding that reflects CSU.

To cope with the fast-paced churn of new technologies and platforms the philosophy of the Project aligns with the model outlined in the Lean Startup (Ries, 2011), and follows the core principle of *Build-Measure-Learn*. The Project is *Build* oriented with a focus on outcomes and actions. These outcomes, those planned and unplanned, will be used to *Measure* results which in turn will allow the university as a whole to *Learn* from the experience. The project is multi-threaded with a number of concurrent areas that cover the trials and the design and development of mobile content and systems. This paper, however, will focus only on the trials as their impact and application runs across disciplines and includes representation from most divisions and all four faculties.

Defining Mobile

One of the biggest challenges we have faced in the project is how to define Mobile. The word 'mobile' has now evolved into an umbrella term used to define the hardware, mobility of the user and the supporting technologies and interfaces. Mobile has become a broader cultural label encompassing the technologies, ideas, customs, and behaviors that accompany these devices. This paper has used the cultural form throughout, except where referring to devices or technology explicitly, but this ambiguity can make the topic quite difficult to navigate and ensure congruent discussion.

Design of the trials

We have chosen to run a number of trials concurrently rather than as small separate projects as grouping them under the one banner makes optimum use of resources and the crossover in knowledge and skills required. The focus has been on encouraging small-scale innovation rather than large-scale outcomes and the trials have acted as an incubator for innovation (Wunker, 2007) and proving ground for new ideas, technology, workflow and praxis. The project has been equipped to provide academic staff and students with access to mobile devices, the required support mechanisms and technically capable staff, so that it can enable staff and put ideas into real world action.

Throughout 2012 and 2013 these device trials were conducted with CSU students and staff using our current infrastructure and learning and teaching contexts. The pilot programs have been structured to be small and have a limited scope, so that multiple programs can be run at the same time and as a whole the project can follow an Agile Methodology (Beck, et al., 2001). The small size makes it much easier to provide focused support to staff and students, affording the ability to change and adapt to resolve issues as they emerge. The aim of this approach is to make it easier to manage risks and reduce failure rates. Shorter timelines for the trials, based around sessional dates, dictated that less time is spent planning and more time doing, and with all the pilots there is a sense of exploration of the possibilities rather than limitations because of the risks involved.

The initial student trials that were conducted during the first session of 2012 were set up through consultation with the Learning and Teaching Sub-Deans in the four faculties who allocated specific subjects and academics. The academics involved and schools' Educational Designers then setup the parameters for the project in consultation with the project's core team. The subsequent trials were set up through an expression of interest open to all staff in the institution for suggestions of trials to conduct in the realm of learning and teaching. These were then screened to align with the objectives of the Project and a number selected to go ahead. The project team provided the required technical support and equipment throughout the trials and were heavily involved in the initial setup and training. A site in the Learning Management System (LMS), our installation of Sakai called *Interact*, was developed allowing access to ongoing support, contact with the team, knowledge base materials, how to guides and video tutorials.

Surveys were conducted at the start and end of each session to learn from these trials and to measure results. The initial survey was designed to gauge participants' access to technology and familiarity with mobile technology. The second survey conducted at the conclusion of the trials asked participants about:

- experiences with the iPad
- experiences with support received in the Project
- activities performed with the device
- time spent on the device
- perceived effect it had on them and their study
- confidence in using the technology
- attitudes towards mobile

- technology preferences
- voicing their views and opinions openly.

The trials can be broken down into three distinct groups:

Phase 1 Student Trials

The first set of trials were conducted in the first session of 2012 and focused on the students' use of mobile technology. iPads were deployed to subjects across three faculties that represented quite different discipline areas and student cohorts. The subjects involved were E-commerce Technologies (ITC594), Investigation: Literacy (EML302) and Nuclear Medicine Science 1 (MRS222). Seven teaching and support staff were also provided with devices.

Phase 2 Staff & Student Trials

The second set of trials were conducted in the second session of 2012 were suggested by academics through an Expression of Interest. The project team and steering committee ensured that the trials chosen aligned with the aims of the project and the strategic needs of CSU. A range of devices - iPads, iPod Touch & Google Nexus tablets - were deployed to across the faculties and included a range of unique and discipline specific applications of mobile technology. These trials are outlined further in the section below.

Library Trials

The library explored the use of iPads and eReaders and the opportunities for lending to students. Initial plans for device lending included supporting students on work placements - also referred to as practice-based learning - lending to remote and distance education students, pre-loading devices with learning resources, eBooks, journal articles, etc. and purchasing apps or other mobile friendly resources.

Conducting the trials

Each trial was to explore unique aspects of how mobile technology could be integrated in the learning and teaching experience. This has provided the project with a range of exemplars and rich findings, each worth of a case study themselves. A brief overview of each trial is provided below.

Library

The iPads and Sony Reader devices were purchased for the Library to explore opportunities for lending to students. There were, however, a number of issues that arose during these pilots. Some of the initial objectives of the Project had to be amended to counter issues relating to licensing and device limitations. For example it was not possible to preload devices with content, nor make the devices available to remote students due to some of the Apple iTunes and App Store terms and conditions and that the lithium batteries used in mobile devices are considered to be dangerous goods, and cannot be transported by air.

Instead, the iPad lending was made available to students on professional placements who had significantly longer borrowing requirements to counter the condition that a device can be associated with only one Apple ID account at any given time and you may switch a device to a different account only once every 90 days. The pilots also ensured that lending terms and conditions were developed, procedures for device management were developed and training for Access Services staff was provided.

ITC594 - E-commerce Technologies

The subject provided the challenge of equipping and delivering support to twenty-one students across multiple cohorts, studying on campus (2 students), by distance (5) and through the Melbourne (8) and Sydney (6) study centres. The devices were used to inform and enhance a research project into mobile technology and eCommerce and provide students with the technologies to explore mobile technology uses. The project was also able to assess the process required for delivery and return of devices to non-internal students.

EML302 - Investigation: Literacy

In this trial twenty-seven students used the capabilities of the device to create multimodal text. They participated in weekly tutorial sessions and were asked to develop writing tasks using the iPad and post these writing tasks to a class blog in an attempt to assess the efficacy of the iPad.

MRS222 - Nuclear Medicine Science 1

This group of thirteen students formed a longitudinal study, as it is a yearlong subject. The same cohort of students has continued their role in the project into 2013. The trial looked at many aspects of integrating the mobile technology into the classroom including the addition of interactive elements to a standard lecture using responseware. The devices were used to provide an information access point and communication tool for students on placement and provision support to students on placement through video chat. The trial also explored the use of discipline specific applications as a learning resource, multimedia capabilities to record learning practice in a video diary, and leverage 3G technology to provide ubiquitous access to subject materials.

Apps in Nursing - Simulation & Resources

A set of five iPads were deployed to the nursing clinic and used in a number of subjects that ran subjects in this environment. Each iPad was set up with the patient monitor app SimMon to enhance the simulation environment in the skills ward at Albury campus in conjunction with simulation manikins that were already *in situ*. Devices were set up in pairs with one becoming the patient monitor, displaying patient heart rate, blood pressure and SpO2, and the second used by the facilitator to change patient vital signs on the first device (the monitor). This would simulate a deteriorating or improving patient. The iPads were also used to access resources such as e-MIMS for students to look up different drugs and acquire the most up to date information. This also extended to a range of other resources available through CSU Library's extensive digital catalogues.

iPads for Accessibility

Three students who engage with accessibility services evaluated the mobile learning environment and access aspects of iPads. Students were asked to asses how the devices would perform for a user with a vision impairment, utilising on-screen enlargement and text to speech software. The assessment extended to how learning resources may be delivered in a variety of accessible formats.

Demonstrating mathematics using an iPad

A team consisting of seven academics teaching physics in the School of Dentistry and Health Sciences and two staff from Academic Support investigated the use of iPads in mathematically based subjects to improve the student experience and performance. One area in particular was how to reduce or break down the barrier for distance students having difficulty with problem solving. Direct interaction with distance students would enable improved problem solving, concept development and retention in highly mathematical subjects. The staff used a range of apps to record drawing and handwriting with voice to create resources that can be stored and sent to students to explain difficult concepts and problem solving instruction.

iPads for Teaching

This cohort of fourteen academic staff from the School of Community Health and School of Environmental Science assessed the utility of the iPad for a range of tasks in academic roles. This included the use of the iPad to facilitate paperless marking, social media engagement with students, investigation of learning resources, implementation of paperless strategies and the integration of mobile technology into a range of teaching contexts across a range of discipline areas.

iPads for Writing

Five students enrolled in the subject, Writing for Publishing (WRT210), assessed the suitability of the iPad for writing extensively and how to capitalise on its portability and extra functionalities. The trial also investigated paperless marking and the use of social media.

Mobile Devices for Digital Media

Students in the subject, Understanding Digital Media (COM112), investigated the suitability of mobile technology for production of digital media. Students were exposed to a range of technology from consumer grade gear through to professional production equipment. The project provided a large cohort of students the ability to loan iPod touch devices through the existing equipment lab in the school.

Findings

The findings from these trials are based on the two surveys conducted, one at the start of the trial one at the end. In addition to this data are written reports from academic staff and informal one-to-one interactions that occurred between participants and the project team. This feedback has enabled the project to explore how students and staff have utilised the iPads and what their views are about various aspects of mobile technology.

Pre-trial Survey

The pre-trial surveys were used to gather information to understand the participants' general level of knowledge, experience and confidence with the devices. In Survey 1 there were 43 responses: EML309 47%, ITC594 26%, MRS222 28% a response rate of 70%. In Survey 2 there were 14 responses: 4 Students, a response rate of 80%, and 10 Staff members, a response rate of 40%. The key measures from this survey were previous use of iPads, confidence in using them at the start of the trial and their current ownership of technology at the start of the trials. The following figures show the averages across the surveys.

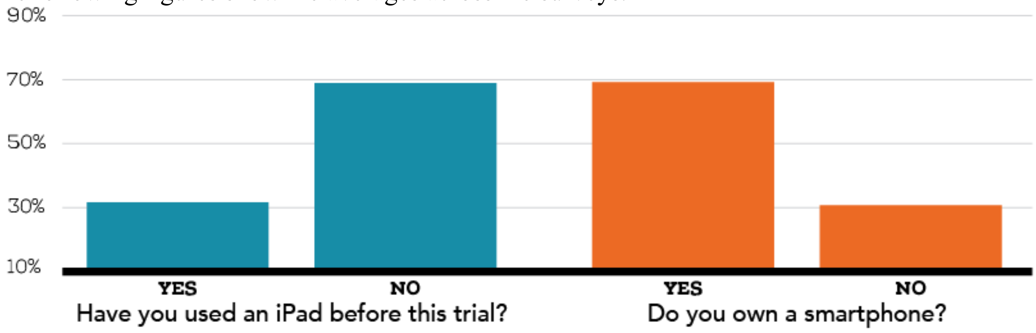

Figure 1: Previous experience with an iPad and smartphone ownership

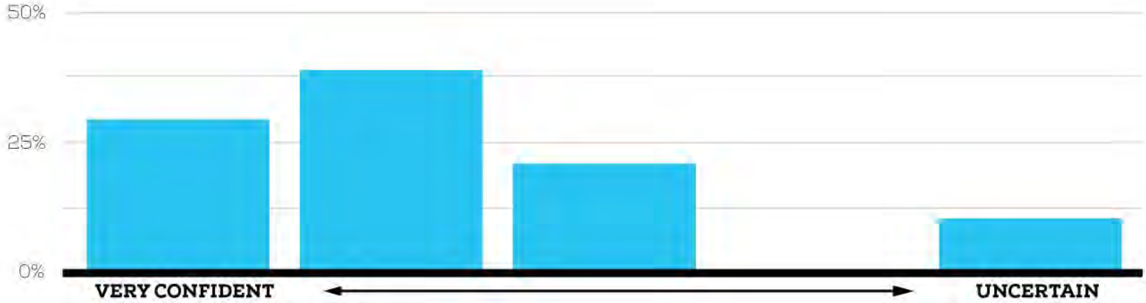

Figure 2: At the start of the trial how do you feel about using an iPad?

These surveys were also used to get a better sense of their expectations of services and content related to the LMS (*Interact*) that should be available on mobile.

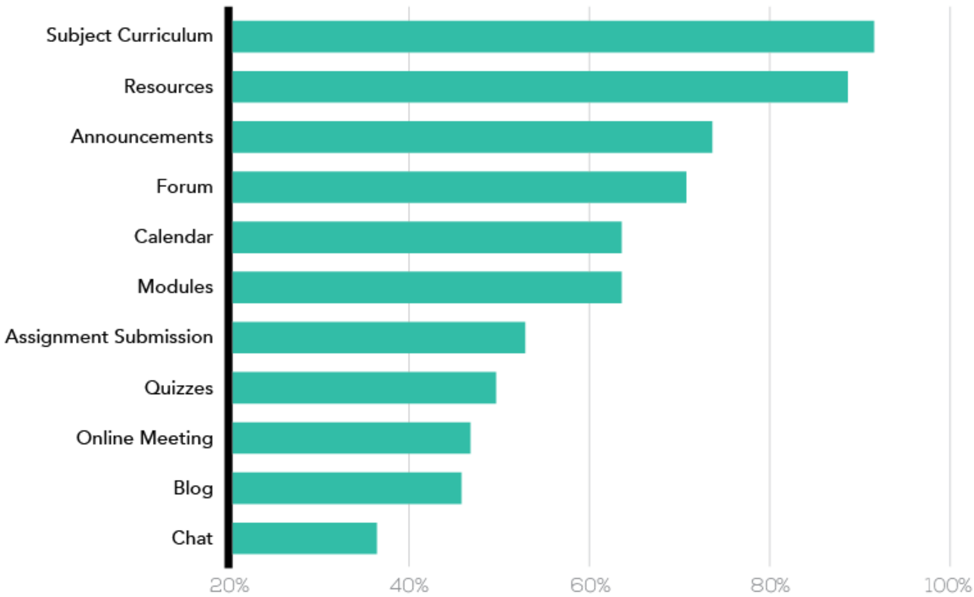

Figure 3: What tools from the LMS would you like to access on a mobile device?

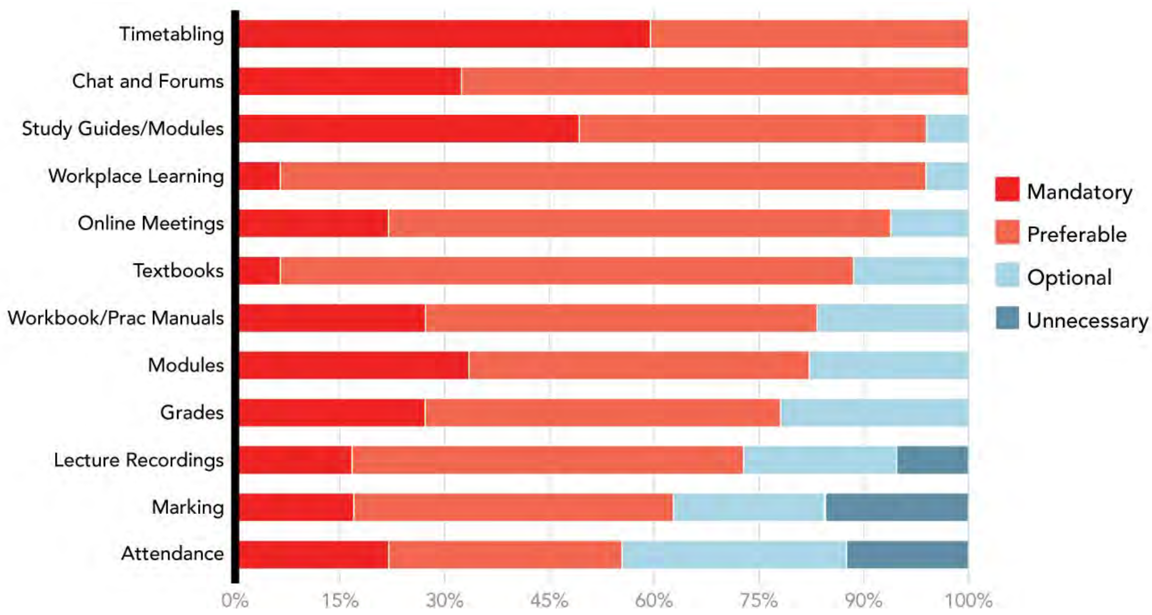

Figure 4 What aspects of learning and teaching should be available on mobile technology?

Exit Survey

The exit survey was used to measure what staff and students had done in the trials, how they had used the devices and how they viewed using the iPads. This survey have been broken up into three participant groups; Student Group 1 were part of the first set of trials, Student Group 2 who were the longitudinal group from MRS222 who conducted the exit survey after two sessions with the iPad, and the final group was made up of the staff participants. Participation was as follows:

- Student Group 1 (SG1): 13 Responses (EML309 77% & ITC594 23%) a response rate of 25%.
- Student Group 2 (SG2): 5 Responses (MRS222 100%) a response rate of 38%.
- Staff Group (STG): 9 Responses (Community Health 22%, Environmental Science 11%, Dentistry & Health Sciences 33%, Academic Support 11%, Other 22%) a response rate of 36%.

Activities on the iPad

One of the key outcomes of the surveys was to gain a better insight into how staff and students would use an iPad. Across the three groups usage can be broken into the following categories:

- **Research/Investigation** - websites, library catalogues and journals.
- **Reading** - online and digital documents.
- **Communication** - email, social media and Skype.
- **Note Taking** - in class, in the field and at home.
- **Video Consumption** - extensive use of YouTube and internal lectures
- **Video & Audio Creation** - staff and students recording themselves as part of their practice, research and learning.
- **Group Work & Sharing** - participation and collaboration around a device and content.

Students reported that they would spend more time accessing their subject outlines, Interact, other learning materials and their lecture when they had an iPad. Access to library, forums and textbooks remain unchanged. The median measurements across the groups showed that **the iPad was used 6.5 days a week for around 1.5 hours each day**.

The iPad's Effect

This section of the survey was used to gain a subjective assessment of how they felt using the iPad may have affected them. Staff and students responded that the iPad wasn't a distraction in class, a distraction in their personal space nor did it make them more focused in class. The majority of staff and students did feel though that the iPad made them feel:

- more engaged and active in class and the subject as a whole;
- it was a benefit during classes and personal time;
- more motivated for study and that they were learning better;
- and that they would recommend the iPad as a study tool.

Technology Preferences
The project trials did not conduct direct comparisons of technologies nor make it mandatory that staff or students use the prescribed technology. Instead staff and students were asked to subjectively indicate their preference from a range of technologies – smartphone, tablet, laptop, desktop and paper – to complete specific tasks and activities. Based on these responses:

- Laptops are the preferred technology to write an essay and use PebblePad (the ePortfolio tool at CSU).
- Tablets are the preference for the following activities: Write a blog/wiki, Access Interact, Access student.csu (which is the central student support website); Access staff.csu (which is the central staff support website); Read your learning materials, Take to Class, Take to Practicum, Take to Conference, Take Home and Device supplied by the University.
- Only one activity that had a preference for paper was "Read your Textbook".
- Smartphones did not receive above 5% on any task and on most was 0%.
- For writing an essay Desktops received 26% of the vote, but this was the only task they achieved above a significant minority.

Some student comments

"We used various apps to make virtual storybooks for children where you could draw your own pictures and add words, audio and voice overs. I found this really useful and ended up using it in another class for an assignment which got really good feedback."
"It was useful for bringing up websites, syllabus documents and resources, whilst typing the assignment on my laptop or iMac."
"Loved being able to relax in an armchair and do reading for uni!!! … it was also great for sharing stuff with others in an informal environment."
"Typing is slow for assignments, which I solved by connecting a wireless keyboard. Apart from that, some lecturers seemed to assume iPads were being used for things other than study in class/lectures and were perhaps not familiar with the possibilities of their use."
"I had to learn a lot of new technology and felt I spent a fair bit of time learning about the technology rather than applying myself to the subject, but that is what happens when you use new technology"

Students were asked what was the most important lesson learned:
"That everything can be much simpler! Aside from typing an essay or notes, the iPad made studying significantly easier, quicker and simpler... it changed the way we studied and it is a big transition to go back to how we were doing it before."
"How beneficial an iPad can be in class. I never really thought of an iPad as an educational tool but after using it for a semester I now realise how beneficial it was to my studies. Reading things online was the best thing and looking up the syllabus"
"That technology should not replace old methods such as using pen and paper and can be unreliable and not suited to all tasks."
"It allowed for my education to be more interactive and engaging. It was really helpful."

Discussion

This section aims to provide a meta-perspective of the trials and develop an overview of the connections and implications that the project has revealed. It is an attempt to go beyond the typical small scale and isolated studies of educational technology and place instead focus on a broader context relating to institutional operations, strategy and resourcing.

The project has made a rigorous attempt to be expansive and touch on a wide range of areas related to our institution, our staff and students to discover the issues and opportunities associated with mobile technology in learning and teaching. Mobile represents a significant opportunity for higher education as we move towards a more digital and online environment. It also presents us with many challenges and questions to explore further about whether our infrastructure, services, practice, support and role as institutions are ready for a technologically different world.

There is significant reward for Mobility

The mLearn project has attempted to find out how mobile technology can be applied to learning and teaching, but also to investigate the possible rewards for its adoption and rollout. The survey and feedback from the trials point to a number of positive outcomes:

3. **Improved Digital Literacies** - The discussions and survey data from the program demonstrates that staff and students are reporting improved confidence and knowledge working with the technology. These skills

are of increasing importance into the future, but developing these literacies further will require ongoing development and support. The introduction of mobile devices into the staff and student technology repertoire has acted as a catalyst for change and personal development providing the foundation and motivation for further exploration.
4. **Supports Current Initiatives** - Mobile technology provides a platform to support many initiatives currently underway across the sector. Student experience and satisfaction programs tend to benefit (ACU, 2011) and the technology is playing a vital role in areas such as paperless marking, recent features to the Moodle and Desire to Learn LMSs. Given the haste and effort shown by all the LMS vendors mobile is also seen as a vital component in the increasing move to online and blended modes of course delivery.
5. **Increased Engagement & Flexibility** - Students and staff have been given much greater flexibility through the technological affordances and improved opportunities for engagement in course and subject work. The devices are able to provide rich and engaging content through apps and digital publications that take advantage of the unique abilities of mobile devices, their sensors and digital affordances like 3D and interactivity. These provide significant opportunities for higher education to develop increasingly interactive, seamless and engaging teaching and learning.
6. **Enhanced Communication** - Mobile devices have demonstrated the ability to open new communication channels with staff and students across a range of social media and online tools. These have been used to improve access to staff and institutional services in the project. .
7. **Reduction in Costs** - In one of the project trials (MRS222) a significant reduction in travel expenditure was achieved through the provision of iPads because it provided a stable platform for contact while on placement. There were also significant reductions in printing attributed to more online content being accessed and the uptake of paperless marking. This has widespread implications for institutions around the world trying to reduce the costs of education for the student and the organization.

The Learning Curve

Most staff and students agreed that the setup process and learning to use an iPad was quite quick and easy and that there is no requirement for much prior learning or skills. However, while intuitive in the design, the iPad still has a significant learning curve associated with its adoption and application. There is a need to adapt not only to the new device but to learn a variety of new concepts and methods of working with this mobile technology including:

- The lack of a visible file system
- A lack of equivalent applications to what is available on laptop and desktop computers
- Cloud computing services are integral to the functionality of the device so a range of new services are required to be signed up for to maximize the effectiveness of the user
- Students are not as sophisticated as we imagined and tend not to be adventurous in their usage, preferring to remain with known approaches.
- Many participants highlighted a lack of available documentation and information around mobile devices, applications, software and usage.

This learning curve points to the need for institutions to provide more information, training and advice for existing and future users of mobile technology. This puts pressure on institutions' professional development and support capabilities. It also opens up opportunities to respond to these challenges in new and emergent ways. The mLearn Project aims to develop a website to act as a hub for this information by the end of 2013 to form a central contact and publishing point for information related to mobile technology and its relationship with learning and teaching.

An Agile Approach

A range of new issues and challenges have accompanied the project's progress and the application of an Agile process has ensured that the team has been able to adapt quickly to changes in circumstances. For example in June 2011 when the outline of the project was still being developed, 25% of the adult population of Australia had a Smartphone. By June 2012 that figure was 49% (ACMA, 2013) and our student statistics point to this being as high as 75%. Traditional project establishment and management methodology are not adequately equipped to cope with these kinds of rapid changes because when things are unexpected they tend to have negative consequences rather than positive (Den, 2013). A technology project today has to contend with extensive technological and cultural changes and as such needs to follow an agile methodology so that it can adapt and evolve to the fast-paced churn of new technologies and platforms to ensure it can not only keep up, but also remain relevant.

Technical Findings

A range of significant technical issues were uncovered during the trials. Awareness of these could assist other universities and highlight areas that may need more investigation, investment and development.

- The CSU WiFi network uses the EAP encryption method that is incompatible with some devices, in particular, eReaders and older mobile devices. This kind of technical limitation can affect the student experience and may also render some devices unusable and redundant.
- The lithium batteries used in mobile devices are considered to be dangerous goods, and cannot be transported by air. For institutions looking at distant and blended education students or remote staff this may have significant impacts. This extends not just to the provision or supply of devices but lending services, through the library for example.
- Licensing limitations around the Apple ID, required to use iPads, affected the planned rollout strategy for loaning devices in the project. These kinds of licensing stipulations can impact the ability for institutions to deliver solutions and force significant compromise and change.
- Many components of the CSU online experience are not mobile friendly and use legacy technology or those incompatible with many mobile devices, in particular Java and Flash. Transitioning systems and learning resources at scale requires significant investment and resourcing. For a project these issues can be compounded by the inability to provide support remotely or scope to resolve systemic issues.
- iPads are extremely robust, the build quality is excellent and no devices failed during the trials. This removed the project's requirements for ongoing support, replacement and spare devices. The value of build quality, look-and-feel, attention to detail and the user experience is often difficult to quantify compared to values like specifications and price. Yet these values play an extremely important component in the overall satisfaction, support and usage of the technology, which can impact a project in many ways, particularly where energy, time and money need to be spent. The value of quality should play an important part in the evaluation of new and innovative technology as it can have significant repercussions in overall cost.

Summary and recommendations

One of the outcomes for the project has been the development of recommendations to be fed back to the university to help imagine and develop the role of mobile technology into the future and have broad applicability to the higher education sector. The project has focused on five key areas.

Provisioning of iPads to Staff

The provisioning of iPad devices to all academic and support staff should be given consideration as part of an accelerator program to increase digital literacy and support other university initiatives. Supplying iPads can underpin the uptake of current initiatives such as increased online content, paperless marking, a reduction in print and innovation in assessment. There is also the benefit of increasing blended and flexible working options. The ubiquity and equity created by this kind of initiative would provide a platform from which further innovation in an institution could occur through app development, cloud services, digital resources and communities of practice.

Provisioning of iPads to Students

The Project cannot endorse a 1:1 rollout across the board to students due to the concerns over sustainability, suitability and the increased preference for Bring Your Own Device solutions. However, there should be scope to develop a full range of provisioning options to assist students access the technology. Some large-scale funded rollouts across specific discipline areas would be useful where they can demonstrate a return on investment, provide significant benefits over existing technology and practices or improve equity and access to the university.

Support and Training

Investment in establishing support staff and training resources for mobile technology at a university level is required as currently there is only limited support from systems and staff. While mobile technology is considered intuitive, it is certainly not free from training and ongoing support requirements and capabilities within the institution need to be developed.

Adaptive Digital Publishing

Learning resources and content fit for purpose on mobile devices is still scant within the institution. Further investigation and development is required to establish a platform-neutral publishing standard that would provide universities with future-friendly content that is flexible and interoperable. These standards will assist in the reduction of content silos and enable the provisioning of learning resources across multiple platforms, devices and publishing points (print, eBook, Web, App) and across an ecosystem of devices.

Internal Cloud Services

Mobile computing relies on the Cloud and investment is needed to rollout enterprise cloud services that can be integrated with a variety of device applications and used across multiple platforms. Investment in a managed Cloud Storage and Services infrastructure would ensure a safe and secure system and a platform for future development.

Areas and Opportunities for Further Research

The project has also highlighted a number of possibilities for further research. These would include:

- The use of mobile as creation tool. This could have significant impact on assessment and new opportunities to leverage the affordance of mobile devices.
- Mobile as a shared resource in the classroom. This would entail using apps as learning resources and be particularly useful in a collaborative environment.
- The mLearn Project team in close cooperation with other sections in the Division of Student Learning is developing a functional proof of concept of Adaptive Digital Publishing due at the end of 2013.

Conclusion

The methodology employed by the project has provided an excellent model for introducing and trialing new technology. The project has been able to conduct a variety of trials across different faculties, disciplines, locations, applications, staff and student cohorts. Conducting real world trials on a small scale has proved easier to support and the team has been able to respond quickly to issues, significantly reducing their impact. The trials have provided us with many lessons as to what works and what does not within our current situation and because they have been conducted in situ - with our students, the current technology and infrastructure - they have provided insight and a better understanding our present environment and capabilities. This has allowed us to develop and contribute to a much more vivid vision of the future.

Mobile is now the New Normal that can no longer be considered an add-on or a nice-to-have; it is the standard technology that more people right around the world have access to than any technology before it - including cars, radio and television (Ahonen, 2011). Mobile is changing technology (Evans, 2013) and represents the dawn of a new normal that is a user-centric ecosystem that encompasses multiple devices - tablets, phones, laptops and desktops. An ecosystem where mobile devices increasingly represent the primary device because it is compact and affordable. We are already living, working and learning across multiple devices and mobile represents just the first wave of embedded and contextual technology. Higher education is entering a stage where we need to change how we think about technology, less about single solutions, more about operating in ecosystems. There is no single device, no single app, and no single service that can provide *the* solution because the new normal is inclusive rather than exclusive, complex rather than simple, and expansive not restrictive.

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Factors to consider when designing writing groups for off-campus doctoral candidates

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In this paper, we outline factors to consider when organizing writing groups for off-campus doctoral candidates, identifying possible design options and the broader considerations that should inform which options are taken. We begin by reviewing issues typically faced by doctoral candidates pursuing their degrees at a distance, such as social isolation and limited access to resources and communities of practice. We then draw on prior studies on doctoral education to discuss ways of meeting the logistical, sustainability and pedagogical demands to be considered by institutions seeking to improve the experience of their off-campus doctoral candidates. We argue that writing groups conducted via CMC tools have the potential to address a number of the issues identified and conclude by outlining a framework capable of informing relevant stakeholders in designing writing groups for off-campus doctoral candidates.

Keywords: doctoral writing groups; off-campus doctoral candidates; computer-mediated communication

Off-campus doctoral candidates

Many issues are faced by doctoral candidates pursuing their degrees at a distance. Many of the issues are similar to those faced by on-campus candidates (Cotterall, 2011), such as mastering the discourses and conventions of candidates' respective disciplines. However, these are compounded by challenges that come as a result of limited exposure not only to research resources (Deem & Brehony, 2000), but also to the "faces" of the academic community into which they are being inducted. Social/psychological issues such as feelings of isolation are much stronger for off-campus doctoral candidates than for those on campus (Chiang, 2003; Evans, Hickey, & Davis, 2005; Katz, 1997), leading to a perception amongst the former that they are working only with their supervisors (Albion & Erwee, 2011). This sense of disconnection and isolation has been found to be a major factor in doctoral candidates' decisions to discontinue candidature (Ali, Kohun, & Cohen, 2006).

Prior research comparing perceptions of on- and off-campus PhD candidates reveals that off-campus candidates have a lower view of their abilities, skills and knowledge (Lindner, Dooley, & Murphy, 2001), and student satisfaction surveys reveal that they also tend to be less satisfied with their overall doctoral experience. When asked to rank their satisfaction with doctoral supervision, intellectual climate, skills development and infra-structure, external PhD candidates in a large metropolitan Australian university have consistently reported lower levels of satisfaction than internal PhD candidates (Macquarie University, MUSEQ-R survey). This is a worrying trend, particularly in an age when an increasing number of candidates are choosing off-campus modes of study.

Of the many skills that need to be developed by doctoral candidates, one that induces much anxiety is mastering the language of the academy (Cotterall, 2011); this “high-stakes” skill is necessary not merely for reporting research findings, but for creating a scholarly identity (Kamler & Thomson 2006). Strong writing skills are essential for PhD candidates if they are to present their research persuasively in a complex, extended written document (the doctoral thesis/dissertation), gain acceptance in a community of academic practice, and increase their productivity and self-efficacy as academics (Casanave & Hubbard, 1992; Kahn & Scott, 1997). Contrary to the assumption that PhD candidates commence candidature with highly developed academic literacy skills, many struggle with the scholarly writing process, and highlight thesis writing and writing for publication as the areas in which they need most training and support (Caffarella & Barnett, 2000).

Tertiary institutions tend to respond to the need for thesis and publication writing training by offering writing courses and workshops, and providing print and online resources. In addition, running research writing groups has been identified as a highly effective method for equipping PhD candidates with not only academic writing skills and rhetorical awareness, but also skills in research collaboration and research project management (Aitchison, 2009; Aitchison & Lee, 2006; Ferguson, 2009; Rose & McClafferty, 2001). Furthermore, such groups also afford an opportunity for PhD candidates to form a sense of community, which has been commonly highlighted as preventing attrition and improving the experience of doctoral candidates (Lovitts & Nelson, 2000). Unfortunately, however, interactive, hands-on research writing support initiated by institutions tends to be delivered face-to-face (FTF), and is usually run on campus, which has precluded the participation of off-campus PhD candidates; this has been particularly the case with the delivery of research writing groups.

Both of the abovementioned problems – limited access to research training and social isolation – have important ramifications on off-campus doctoral candidates’ productivity and well-being, but can potentially be addressed through the use of computer-mediated communication (CMC) technology which enables synchronous and asynchronous contact with peers and facilitators. Indeed, the potential of synchronous computer-mediated communication (SCMC) technology to improve the experience of distance learners has been frequently highlighted in the literature (Albion & Erwee, 2011; Eastmond, 1995). SCMC tools such as Skype and Collaborate have previously been noted as viable alternatives to FTF meetings between off-campus doctoral candidates and their supervisors (Cotterall, 2011; Walker & Thomson, 2010). Furthermore, studies have shown that SCMC-enabled meetings can heighten social presence and decrease doctoral candidates’ feelings of isolation (Erwee & Albion, 2011). Clearly, these tools hold considerable potential for running writing groups for off-campus doctoral candidates and should be used by institutions for improving experience of off-campus doctoral candidates.

Design of writing groups for off-campus doctoral candidates

Many factors need to be taken into account when planning writing groups for off-campus candidates. For CMC-enabled writing groups to constitute a viable response to what are perennial issues for geographically dispersed HDR candidates (namely, thesis writing challenges and social isolation), they need to simultaneously meet logistical, pedagogical and sustainability considerations. Since off-campus doctoral students are likely to have multiple work-related or family commitments which may limit their availability for participating in CMC-enabled writing group, it is important that the timing of the meetings is appropriate and suitable for all group members. Furthermore, considering that one of the main goals of the group is to assist participants in improving their peer review and research writing skills, it is critical that the writing groups should be run according to sound pedagogical principles, for instance, encouraging joint meaning-making through interaction and negotiation (Palincsar, 1998; Vygotsky, 1978). Finally, the ideal CMC-enabled writing group for off-campus candidates would not be prohibitively costly or place unreasonable burdens on the institution or students to set up, as the use of expensive software or high demands on the participants’ time would likely render this practice unsustainable in the long-term (Sterling 2001).

These considerations are not exhaustive and the design of the group can be influenced by other factors. In an attempt to tease out what the three considerations involve, we propose a tentative framework which conceptualizes the complex nature and variety of potential types of writing groups for off-campus doctoral candidates, and could be used as a useful starting point for those considering their implementation. Figure 1 below summarizes a set of options for those designing writing groups for off-campus doctoral candidates, classified into three characteristics: the group’s locus of administration, its level of facilitation, and its mode of delivery. These three characteristics are described in turn below.

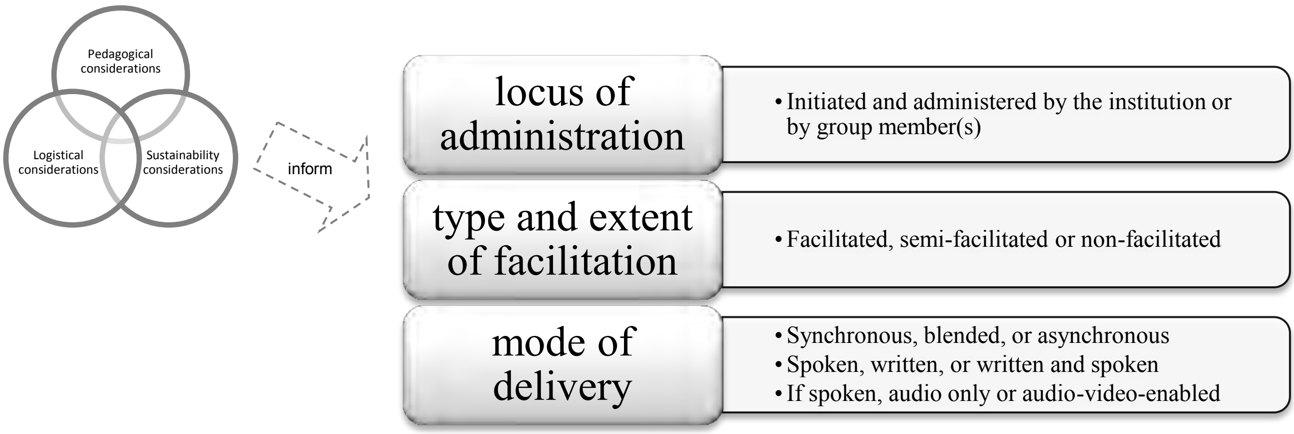

Figure 1: Design options for distance writing groups, informed by wider considerations

A doctoral writing group's locus of administration includes but is not restricted to its locus of initiation. A group may be initiated, promoted and overseen by an institution or someone representing the institution (e.g. a centralized unit of a university, a particular faculty, department or research group, a supervisor), or by participants of the group (in this case, doctoral candidates) themselves. Literature and empirical observations (for instance, Huang, Chen, Olmanson, Sung, & Kim, 2010; Mercer, Kythreotis, Lambert, & Hughes, 2011) have reported instances of both types of groups in FTF settings, and one could expect that the dynamics, interactional patterns and the functioning of the groups will differ between institution-administered and student-administered writing groups. For instance, it is likely that the former would be run based on prior institutional experience, whereas the latter would feature a higher concentration of role and procedure negotiation among the participants. Furthermore, the locus of administration could have an impact on the group's sustainability: participants of student-administered writing groups may have a greater investment in the group and thus be prepared to devote more time and energy to ensuring that it continues than those who have had the group established by an external party. On the other hand, the logistical challenges and investment in time involved in identifying and connecting sufficient numbers of remotely-located students into a cohesive writing group would in most cases be assumed more readily by an institution than by individual students.

Related to locus of administration is the type and extent of facilitation provided to a group. Both FTF and SCMC-enabled writing groups may be run with or without the help of an "expert" (or at least experienced) facilitator, who manages the discussion and scaffolds the work of the group. The facilitator may have specialist knowledge and expertise in research communication, in the discipline(s) to which group members belong, or in both. While we would call groups with an external expert present "facilitated", the absence of such an individual from meetings does not render a group "non-facilitated". A group may be facilitated in the start-up stage by an expert, who later withdraws, effectively weaning the group of his/her guidance; the facilitator could then be invited to return on occasions when the group requires his/her advice or guidance. Furthermore, print/online resources (such as short video tutorials on various academic writing issues, guidelines for managing group dynamics, written advice on how to seek and give feedback appropriately, editing guides and rubrics) can be made available by institutions to help doctoral candidates establish and run their own writing groups; a good example of such resources is RMIT's Research Writing Group kit (RMIT Study and Learning Centre 2013). We would call groups that are facilitated only in the start-up stage or that use such learning resources "semi-facilitated", reserving the term "non-facilitated" for groups that neither include the guidance of an expert at any stage nor draw on resources designed for use in writing/peer-learning groups. From certain perspectives, the guidance of an expert facilitator in a doctoral writing group has pedagogical and logistical advantages; for instance, meetings can be structured to focus on specific writing issues or to meet certain explicit learning outcomes, and facilitators can take responsibility for setting up and managing meetings, selecting and setting up software and equipment for SCMC-enabled groups, and reminding members of meeting times and document circulation dates. On the other hand, non- and semi-facilitated groups may surpass facilitated groups in terms of both pedagogy, as they encourage learning autonomy and ownership of learning outcomes, and sustainability, as they require fewer human resources to implement and support. More research is needed to investigate the dynamics and relative advantages of differently facilitated writing groups.

A third and very important set of decisions which designers of distance writing groups need to make relates to the mode of delivery or channel of communication through which feedback and discussion will be conveyed.

Should communication amongst members be synchronous or asynchronous or a blend; spoken or written (typed); and if spoken, then audio-video-enabled or audio only? Modern technology offers a host of tools, both freeware and licensed, which make all of these options possible, but the selection of a particular tool should again be informed by logistical, sustainability and pedagogical considerations. Logistical considerations include accommodating for the number and locations (time-zones) of group members; ensuring access to necessary hard- and software; and catering for different connection speeds and technical competencies (e.g. typing and navigation speeds) of group members. Sustainability considerations also impact these logistical decisions, since generally more cost-effective and simpler technology configurations are more sustainable. To be pedagogically sound, a mode of delivery would need to be selected such that members have sufficient time to review others' texts and can contribute to discussions freely and equally during meetings, and that feedback is respectfully delivered, comprehensible and itself amenable to analysis and critique. Clearly, empirical studies are needed to determine the effects that various technological configurations actually have on group dynamics, learning outcomes and user satisfaction levels.

Conclusion

This paper has identified a number of decisions that need to be made when designing writing groups for distance doctoral candidates. Outcomes of these decisions will determine three characteristics of the group: its locus of administration, the type and extent of facilitation or external support on which it relies, and the channel or mode of delivery through which communication takes place amongst the group members. While these characteristics will clearly have an influence on the dynamics of the writing group, they need to be made with broader considerations in mind, namely those of logistics, sustainability and pedagogy. The challenge for stakeholders seeking to set up (S)CMC-enabled writing groups is to determine the most appropriate tool(s), the optimal group size, and the most suitable type and level of facilitation so as to best meet the needs of their off-campus doctoral candidates. There is clearly a need for empirical research on the dynamics and the experiences of distance writing group participants, to provide educational researchers and practitioners with information on the implementation of various types of groups. Such research would be highly beneficial for those working in doctoral education.

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Assessing Collaboration in a Web-based Constructivist Learning Environment: A Malaysian Perspective

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This paper focuses on studying the students' collaborative processes within a web-based learning environment. A constructivist web-based learning environment was designed using Jonassen's (1999) CLE model, and centered around a multimedia group project and the use of web 2.0 tools. The project was undertaken by students at INTI International University, Malaysia, and worked in a project group of 4 members. This study assesses students' perception, attitude change, language acts through the use of several data collection instruments, including questionnaires, open-ended questions, interview, and students' interaction records in web-based applications. Factor analysis was performed on quantitative data, whereas the framework of CMCL was used to investigate the qualitative data to identify the collaboration and communication through their communicative acts during project development process. Results showed that group collaboration provided peer support, increased their motivation and satisfaction, and more communication and interaction were stimulated in the learning process.

Keywords: collaborative learning, communicative acts, web 2.0 tools, constructivist learning environment, Malaysian classroom learning

Introduction

Today, the job employers are looking at graduates to have skills and abilities beyond the textbook and course syllabus (Tan, Teo & Chye, 2009). It now becomes an added advantage if graduates are able to adapt to different situations, learning independently, and be comfortable interacting with people with different backgrounds. Therefore, nurturing such potential employees has become the main objective for reforming the education context today. The traditional approach of teaching which emphasized on individual ability in re-producing the knowledge is no longer suitable for this competitive job market. Instead, knowledge sharing and collaboration are more in demand, and acquiring such skills would require educational learning environments to promote active learning process and experiences in collaborative learning (Chiong & Jovanovic, 2012; Thanh-Pham, 2010). Up to date, most of the studies on online collaboration place focus around the ways of creation or effective factors for bringing the success of online collaboration (Chiong & Jovanovic, 2012). However, it has fewer studies on the values or aspects of the processes in the collaboration and communication, especially when students were collaborating and interacting on project tasks with the use of web-based social tools. In addition, Cecez-Kecmanovic and Webb (2000) highlighted that the social nature of learning is a key feature to differentiate collaborative learning from individual learning, and such social interactions need to be mediated through the language used to comm c No fo g g od y's w b 2 0 oo s mo c p b o s p po h o collaborative activities and asynchronous communication. Hence, this study focuses on assessing the students' collaboration and communication processes within a web-based constructivist learning with the incorporation of Jonassen's (1999) components of constructivist learning environments. The objective of this study is to identify the important aspects from both quantitative data and qualitative data, in order to investigate the essential values which can harness the key collaborative features for increasing the student engagement in the collaborative learning process, therefore the current model of collaborative learning can be extended by including the dimension of using web 2.0 social tools.

Collaborative Learning in Classroom Setting

Studies on collaborative learning reveal that students who learn in isolation do not learn as much as students who have connection to a network of social relation that establishes the peer interaction (Pun, 2012). This peer interaction integrates many perspectives which motivate students in playing a role in the community, solving high-level problems, and producing better intellectual outcomes (Pun, 2012). Collaborative learning is defined as a learning method which has common goals in an activity that require a group of students to communicate in order to obtain the learning resources, and construct a shared conception or joint solution to a problem (Garcia, 2012; Suh, 2011). Many researchers have shown that the educational advantages of collaborative learning make student learning more effective and much appreciated by the students (Chiong & Jovanovic, 2012). This is because the collaborative work group can nurture the student confidence to be more matured and skillful in self-reflection, which will improve their understanding on the topics being studied. In addition, small collaborative work groups also strengthen the leadership among the members as it requires equal distribution and contributions from each member, which can be considered as training for learners to solve conflicts and establish trust among themselves (Finegold & Cooke, 2006). Other researchers have also found that the learners derive a sense of enjoyment when working collaboratively as it brought them a better learning experience, showed them different perspectives and achieve better academic results (Chiong & Jovanovic, 2012). Thus, more and more educational institutions have refined their instructional approaches and curricula to complement these current directions and practice, by increasing team-based projects and assignments, which require collaboration among team members. Today's graduates are not only expected to be more responsible in continuous learning and be able to interact to build knowledge, but they are also evaluated on varied skills in adapting to different situations and in socialising with different people who comes from different cultural backgrounds (Chiong & Jovanovic, 2012; Pun, 2012). This is due to the advancement in ICTs and network facilities that enable connections and communication of all geographically distributed tasks and people. Therefore the roles and approaches of learning are evolving from individual performance to collaborative group assignment. In order to be more competent and stay competitive, students in tertiary studies need to be exposed to collaborative group-based coursework in order to obtain the skills and experiences which can then be transferred to this work environment (Chiong and Jovanovic, 2012).

Constructivist Learning Environments as a Platform for Collaboration

Collaborative learning is underpinned by constructivist learning approaches of Piaget (1952), Bruner (1985), and Vygotsky (1978), where students play active roles in their learning process, outside of a teacher-centric environment, and take ownership and responsibility for their learning outcomes. Collaborative learning is not only for students to articulate their viewpoints to others, but also for creating new knowledge, clarifying or building upon existing knowledge and deriving new meaning. In such a learning environment, students engage in collaborative activities, tap into their teamwork skills, and use some solutions to accomplish their tasks. So everyone in the group is responsible for managing group process, resolving conflicts and negotiating their outcomes and contributions to their learning goals, thus, gaining a holistic collaborative learning experience.

Constructivist learning environments incorporated the key features such as ill-structured problems, collaborative activities, facilitation and support, and reflection. Jonassen (1999) suggested a model for designing constructive learning environments (CLEs) with the following:

1. **Conception of the problem**. A problem for the students to begin their learning development, and such problems should be grounded in a relevant context to the student to manipulate and support.
2. **Interpretation**. Students interpret and develop solutions to their problems, based on prior experiences, and some related cases can be provided to scaffold their memory with different perspectives.
3. **Information sources to support the understanding of the problem**. The learning environment provides the information that learners need to understand and solve problems, and additional information (text documents, graphics, sound, video, and animation resources) can be accessed through World Wide Web.

4. **Cognitive tools.** Learners interpret and manipulate aspects of the problem through the World Wide Web as a cognitive tool, which allow them to visualise and construct mental models of their solutions, performance tools, information tools and knowledge modeling tools.
5. **Conversation and collaboration tools.** Learners form communities to negotiate and co-construct meaning through some useful tools. Students require a platform to share and exchange their ideas and create a community to solve their problem collaboratively, and to facilitate and foster communities of learners.

Jonassen (1999) posited that an essential part of the learning problem is that it has to be interesting, engaging and appealing. It must also be authentic, personally relevant, challenging and interesting to learners, and provide a physical simulation of the real-world task environment. By collaborating with one another, students are exposed to multiple perspectives to their learning problems, enabling them to engage in collaborative activities with their team members, as well as with the instructor, who acts as a facilitator and guide. In addition to this, the web has been a key component for such collaborative activities to take place. In recent years, there has been a growing interest in Web 2.0 tools that are also known as web-based 'collaborationware' such as wikis, blogs and podcasts (Boulos, Maramba, and Wheeler, 2006). The availability of these Web 2.0 tools such as social networking sites, blogs and wikis, students are provided with many opportunities to generate user content and participation. These tools successfully invite students and learners to participate, as they would be more inclined to participate and collaborate in a platform that is familiar to them (McCarthy, 2010). Furthermore, Web 2.0 tools like blogs can be written by one or more contributors and this feature engages the content creator and the readers to participate in the sharing of knowledge and debates. When used in the right context, these technological tools can "encourage learners' deeper engagement with learning materials" and as such have the potential to be powerful collaborative tools for information sharing (Boulos et. al, 2006). This is further supported by Parker and Chao (2007) who state that Web 2.0 technologies have the potential to "complement, enhance, and add new collaborative dimensions to the classroom". Therefore, this study sought to incorporate web 2.0 tools into the CLE to provide more opportunities for student collaboration.

Successful collaborative learning also requires that students engage is not only collaborative product outcomes but also in the development of their communicative acts (Cecez-Kecmanovic and Webb, 2000). There is a need to not only evaluate students' perceptions on the collaborative processes but also in the value of their collaborative learning (Treleaven 2003). Cecez- Kecmanovic and Webb (2000) developed the framework of Communicative Model of Collaborative Learning (CMCL) based on the social theoretical foundation of collaborative learning, to study the productivity of the collaborative learning context and the way to improve the practices. Specifically, the communicative analysis focuses on the flow of linguistic acts in student discussions, and how these discussions contribute to the collaborative learning processes. The CMCL assesses student communicative acts across 2 dimensions:

1. **Dominant orientation of learners** shows if students were orientated towards learning, achieving ends or self-representation and promotion
2. **Domain of knowledge** identifies students' orientation towards the subject, norms and rules or personal experiences, desires and feelings.

Therefore, this study sought to develop a collaborative web-based learning environment, and investigated the aspects on how students collaborate and communicate while developing a group-based multimedia project.

Methodology

This study is to look into the process of collaboration and communication within a web-based approach in constructivist learning environment. The study consisted of 104 students who were taking the selected subject, a common subject that offered to all IT Degree students at INTI International University in year 2012 and 2013. The learning environment adapted Jonassen's (1999) CLE model, where students were required to work on a group-based multimedia project as for fulfilling their coursework requirement. Each of the students was allowed to form their own project group which comprises of 4 to 5 members, and then they were required to work collaboratively with their peers to share opinions and experiences, maintain good relationship and interaction with the group members, and solve the given problems with their new knowledge. As for the communication and discussion of the project development, all students were strongly recommended to interact through several web 2.0 social tools. In order to encourage fair contribution, each group member is required to contribute at least one part in the multimedia application.

In this study, both quantitative data and qualitative data were collected to assess the student perceptions on the collaborative learning, and to investigate their language acts which recorded while interacting with others. Data collection instruments included: 1) - a questionnaire which was used to collect the student feedback, consist of

40 survey items, and measure on a 5-point Likert scale, ranging from '5-Strongly Agree' to '1-Strongly Disagree', 2) - open-ended questions and interview to collect the students' feedback on learning experience, and 3) – recorded details in web 2.0 social tools. A total of 104 completed set of questionnaire were collected. Data from the questionnaires were analysed in SPSS software, whereas student comments and feedback were assessed by using the framework of CMCL. Figure 1 shows the project design and student learning workflow. As can be seen, the design of the multimedia group project was made consistent with the constructivist learning approach which centred at an issue which required students to propose new ideas, and develop a multimedia application. Each student needed to do background study individually, and then share their findings, followed by developing the multimedia application based on their assigned task or personal strength. In the entire planning and development process, all students collaborated and communicated through the web 2.0 social tools. In fact, the lecturer who designed such learning approach also involved in the process of students' online communication and interaction, so that she can be a facilitator through the student learning process. In addition, she also collected the details in students' collaboration and communication for more analysis as she also played a main researching role in this current study. Figure 2 below shows the collaborative process of students.

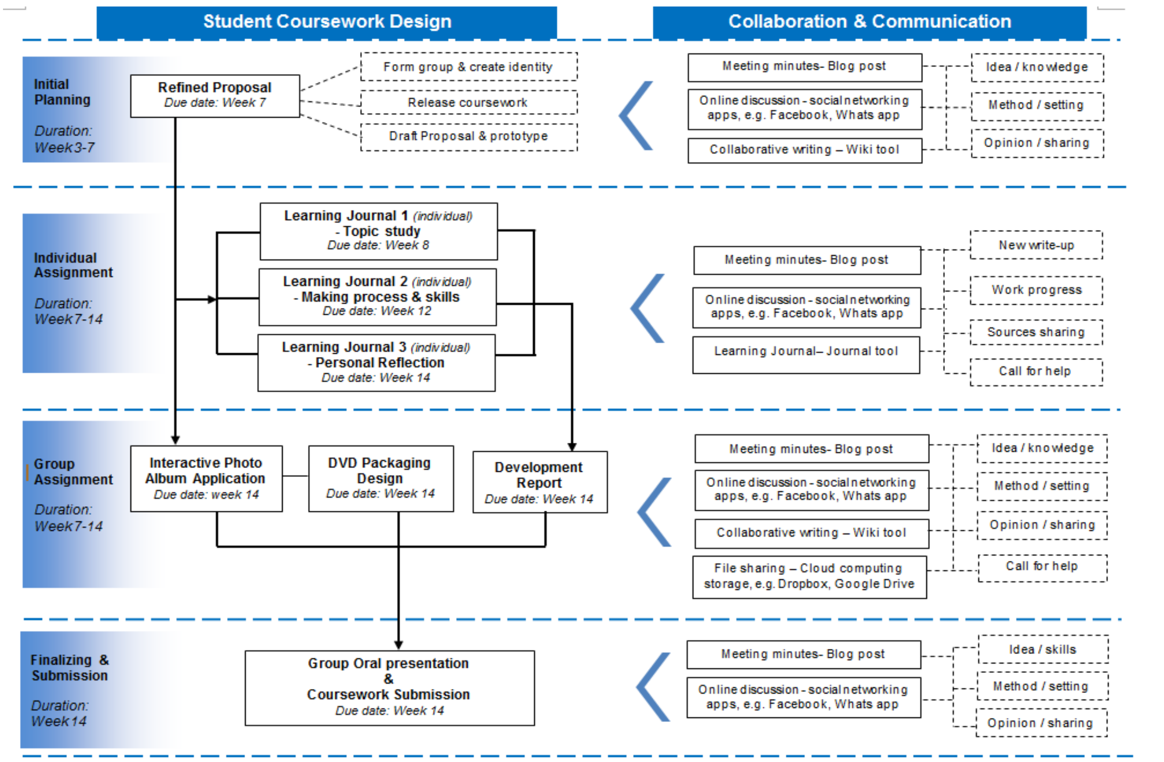

Figure 1: Students' learning workflow in the learning environment

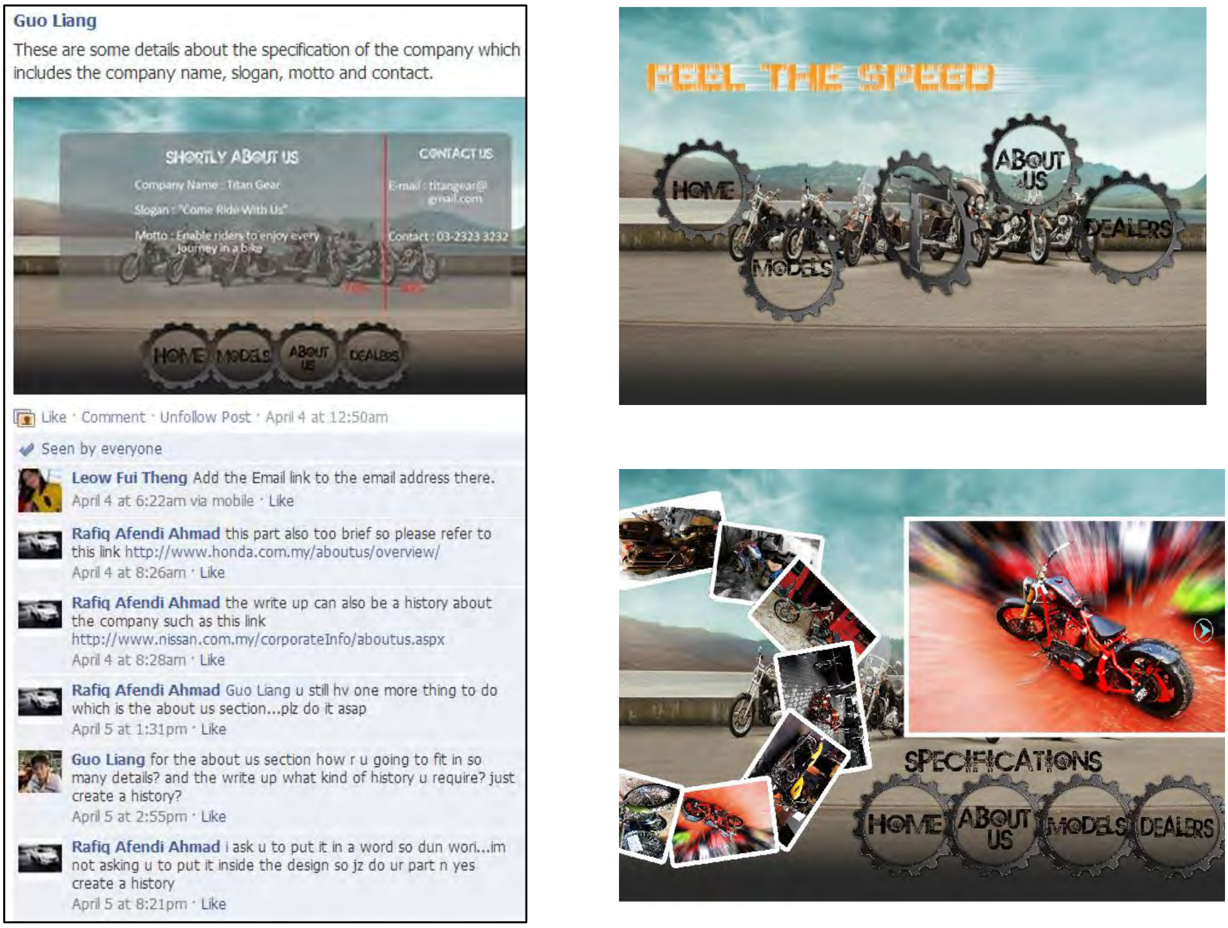

Figure 2: Discussion and sharing of work progress among the members in Facebook project group *(left)*, and the screenshots of their final work *(right)*

Results and Data Analysis

The results and data analysis are based two types of data: quantitative data and qualitative data. Firstly, the quantitative data from the survey results was processed by using SPSS software to carry out with the factor analysis. This is to find a number of constructs that representing the relationship among sets of interrelated variables from the item response (George & Mallery, 2011). A principle component analysis (PCA) was conducted on 40 survey items with orthogonal rotation (varimax). By using Kaiser-Meyer-Olkin (KMO) measure to verify the sampling adequacy, it was found that KMO = .856, which is a great value according to Field (2009). As for Bartlett's test of sphericity X2 (780) = 2372.533, p <.001, this indicated that the correlations between items were sufficiently large for PCA. Next, the eigenvalues for each component were obtained, and nine components were found to have eigenvalues over Kaiser's criterion of 1, so this combination was capable of explaining 67.041% of the variable variances. However, when scree plot was used to study the inflexions, it justified for retaining both components 3 and 9. Based on both criterions, it was decided that three components were retained in the final analysis. Lastly, there were 37 survey items selected and each had been clustered into one of the three components.

Each component was represented as a construct with a suitable theme: construct 1 - 'Collaboration among Group Members'; construct 2 – 'Personal Satisfaction and Self-Enhancement'; construct 3 - 'Communication and Interaction'. Table 1 below presents the responses of item which loaded high onto each of the three identified constructs. The items responses include mean score (M), standard deviation (STD), percentage of cumulative percentage of agree and strongly agree responses (%). Specifically, in Table 1, there are a total of 16 survey items loaded onto the first construct, 16 survey items were loaded onto the second construct, and 5 survey items loaded onto the third construct.

Cronbach's Alpha test was also done by using SPSS to assess the reliability of each of the construct. According to George & Mallery (2003), it can be deemed as reliable when the Cronbach Alpha is over 0.7. Based on the statistical result from 104 students' input, the value of Cronbach Alpha shows 0.912 for construct 1; 0.909 for construct 2; and 0.762 for construct 3 (see Table 1).

Table 1: Responses of survey items for each of the constructs

Survey Items	*M*	*STD*	*%*
Construct 1: Collaboration among Group Members			
1. I got to know my group members well	4.22	.710	83.65
2. My group was supportive of member's problems and helped resolved them	4.13	.797	80.77
3. My group helped me do my best in the project	4.10	.842	76.92
4. My group communicated well with each other	4.08	.832	78.85
5. Our group encouraged positive contributions from each member	4.05	.805	78.85
6. My group leader was very effective	4.04	.891	73.08
7. My group worked well together to present our project	4.01	.770	76.92
8. My group was able to solve our problems and conflicts in a positive manner	4.01	.731	79.81
9. My group taught me some things I would not have learnt on my own	3.99	.930	81.73
10. Our meetings were well attended	3.96	.869	71.15
11. The project allowed me to analyze, synthesize and evaluate information properly	3.92	.733	79.81
12. I enjoy working in a team	3.87	.925	69.23
13. I found using the Web to communicate my progress very useful in my learning	3.83	.818	73.08
14. There was a lot of unity in my group	3.81	.848	71.15
15. My group's interactions were smooth	3.73	.937	62.50
16. I was able to maintain contact with my lecturer	3.73	.927	63.46
N = 104; Cronbach's Alpha = 0.912			

Survey Items	*M*	*STD*	*%*
Construct 2: Personal Satisfaction and Self-Enhancement			
17. The project increased my understanding on how to manage and develop an interactive application	4.15	.760	82.69
18. The project made me want to do my best	4.09	.684	84.62
19. I found the project to be challenging yet stimulating to do	4.02	.824	79.81
20. I am now able to apply my skills in a more effective manner on future projects	4.00	.724	82.69
21. The project enhanced my learning of interactive multimedia	3.97	.717	77.88
22. The collaboration was a challenge but I enjoyed it	3.94	.879	75.00
23. I enjoyed using the web to acquire information for my project	3.91	.802	74.04
24. I learn more from the collaboration than on my own	3.90	.795	75.96
25. This project allows me to develop skills needed in the real-world	3.89	.736	77.88
26. I am now a better learner	3.87	.789	66.35
27. I am very satisfied with my contribution to the project	3.86	.756	69.23
28. This course has given me confidence in my newly acquired skills and knowledge	3.85	.734	75.00
29. I saw the relevance between the course and real world situations	3.84	.849	74.04
30. I enjoyed working on a project like this	3.84	.915	69.23
31. I am now able to think critically about developing interactive web applications	3.82	.810	69.23
32. I was very motivated to do this project	3.74	.836	71.15
N = 104; Cronbach's Alpha = 0.909			
Construct 3: Communication and Interaction			
33. We were able to contribute our creative ideas in the group	4.05	.716	82.69

34. I was able to interact well with my classmates	3.82	.734	73.08
35. We were able to present our project well using multimedia	3.80	.793	67.31
36. My group was able to make and follow a set agenda	3.72	.730	66.35
37. We were able to organise our work effectively	3.70	.880	63.46
N = 104; Cronbach's Alpha = 0.762			

Besides the quantitative data, it also includes the qualitative data which can further support the survey results, and it consists of students' comments, feedback, and communication transcripts during the activities within the learning environment. All these qualitative data was analyzed by using the Cecez-Kecmanovic and Webb's (2000) Communicative Model for Collaborative Learning (CMCL) along the two dimensions of communicative analysis: 1-knowledge domain of linguistic acts; 2-learners' dominant orientation.

Table 2 presents the breakdown of CMCL with three domains (1 to 3), and three orientations (A to C), hence forming a framework which has the cell arrangement with 3 x 3 scheme. In each cell (ranging from A1 to C3), the students' comments or communication responses which collected during the data collection process, were analysed and then sorted into a cell based on the types of communicative acts in their collaboration and interaction processes. These comments and responses can then be used to identify more aspects and understand the students' perspectives.

Table 2: Students' collaborative communication responses

	1 - Subject Matter	2 - Norms & Rules	3 - Personal Experiences, Desires & Feeling
A – Learning	**A1 - Understanding on the Project Topic** - *"…sharing new info with group member it help each of us to have variety type of idea, we learn more."* - *"…when we think doing this way… then when another idea pop-up, we change, to improve..."* - *"…different people to went through the coding, and I found the problem…."* - *"…when there are some trouble with the Flash part and we will be called to fix and solve the problem"*	**A2 - Approaches on Acquiring Information** - *"…member designed their interface and presented it, we voted the best."* - *"…when we finished our part, we will ask each other to check. If some of the members are not like it, we will try to change it…"* - *"…I feel it's convenience to communicate by the chat box…."* - *"We have face to face conversation and using Dropbox to share work…"*	**A3 - Experience in Managing Learning Process** - *"…it helps us to recall back what we learned from our lab classes and do more self research regarding those skills and project topic…"* - *"This project we not only apply what we learn in the class but also do reached about which we not learn in the class."* - *"We will know each other's strengths and weakness."* - *"…I'm happy that I have members with dedication."*
B – Achieving Ends	**B1 - Achieving Project Tasks** - *"We can done one flash application without any bug, within the time complete all parts…"* *"…done the project as proposed in the proposal, having fully function features and high quality."* - *"During the break, we had to meet up 3 times and stayed from early noon till early night to try to do as much as we can…"* - *"… [1 member] failed to complete his task, we shared the work of his…"*	**B2 - Delegating Project Tasks to Members** - *"we held meetings, each member would describe their respective interest regarding the project and then we would divide the job appropriately."* - *"…Photoshop work is done by other mates…the flash part i did as that it is where my strength…"* - *"We made a schedule that listed down the activities to complete the project…"*	**B3 - Students' Feeling on the Project Tasks** - *"…I feel happy that could finish the project in this short period of time."* - *"…I felt really proud for every one of them and also myself pay lots of effort"* - *"…each one knew what was doing and accomplished his part without delay…made our project a good result."* - *"…my group is the best because we was work very hard and manage work with consistency and make the project in perfect work."*
C – Self-representation & Promotion	**C1 - Students' Opinion on the Project Topic** - *"I find this project very helpful where I understand Adobe Photoshop… and got an experience with Flash."* - *"…self-study helps me to understand more on the topic and also enhance the skills…"* - *"They ask me to join because I got new ideas then they like my ideas, so we work together..."* - *"…I'm the one choose the themes for the project and did the proposal…"*	**C2 - Working with Team and Protocols** - *"…I need to call meetings, finalize ideas, manage the project..."* - *"I was the driving force…organising work sessions and reinstating the theme of the project..."* - *"…we take diploma together so we familiar with the personality and the pattern of doing work"* - *"I chose my members because I know them for quite long and we've already worked together on other projects."*	**C3 - Students' Feeling on the Group Works on Overall** - *"The motivation is you know this is your part, and what you can do, and you have the freedom to do."* - *"…I enjoyed doing this project because I am a creative person and I could engage my creative on the project…"* - *"…I like to see some other people's design, so I can absorb the ideas..."* - *"…I realized that there are many things that I do not know… the way on making a product stands out..."*

Discussion

From the data analysis of this study, there are some important aspects found about the student learning experiences especially in the collaborative and interactive processes when learning and working on the group project with the web-based collaborative approach. These aspects were divided into two parts, from the quantitative data or qualitative data respectively.

1. Collaboration among Group Members

Based on the results, it shows that group collaboration encouraged the students to perform better, and when they received peer encouragement, their confidence level in working with the project were also increased. This can be seen from some significant result, there is 78.85% of students agreed that their group encouraged positive contribution from each member based on their own strengths during the project development process (see Item 5 in Table 1). On the other hand, 79.81% of students agreed that the project gives them the chances to analyze and evaluate the information, so encourage them to open their mind and think out of the box (see Item 8 in Table 1). Besides the increase of confidence level, peer support also enhances their work performance, and this can be noticed from the significant results: 80.77% of students agreed that their problems were resolved by their group's support, allowing them to continue with other work in the development process (see Item 2 in Table 1). 81.73% of students agreed that through the support of group, their knowledge was enhanced, which would not be learned all individually (see Item 9 in Table 1). Hence, the students learned to support each other to enhance the project works, which subsequently improving their communication skills to cooperate and interact with each other. It can be found through some of the significant results: 83.65% of students agreed that through group collaboration, they become more familiar and better understood their group members (see Item 1 in Table 1). 78.85% of students responded that they could communicate well with their members for more information, so potentially improve the quality of group discussion (see Item 4 in Table 1).

2. Personal Satisfaction and Self-Enhancement

It was found that personal satisfaction was an important aspect for student learning, and can be gained from having motivation in the learning process and in being challenged in its complexity. This can be seen in the students' response: 84.62% of students agreed that the project had motivated them to willingly devote their effort in the development process for better outcomes (see Item 18 in Table 1), and 79.81% of students agreed that the project given was challenging their ability and knowledge but they realized that this project is stimulating and provoking their dedication and efforts (see Item 19 in Table 1). It was also found that from having better understanding or acquiring new skills, they became more capable in managing the project development and in unleashing their potential for future advancement. Obviously, there are 82.69% of students agreed that through working in the development process of the project, they could gain more understanding on the way to manage and develop an interactive application (see Item 17), and 82.69% of students agreed that they were able to apply the newly acquired skills on future projects with more effective manner than this round (see Item 20). The new enhancements bring the enjoyment in learning to a higher level, and therefore it is believed that it has been transformed into a part of personal satisfaction. Some significant results show that 75% of students agreed that they did enjoy with having the collaboration although it was a challenge for them (see Item 22 in Table 1), and 75.96% of students reported that the collaboration mode made them to learn more than self-learning (see Item 24 in Table 1).

3. Communication and Interaction

The design of this learning approach was found to be able to foster communication and interaction, especially when discussing the ideas, interacting for better decision and presenting the outcomes. This can be seen in the students' response that 82.69% of students agreed that they were able to interact with other members by contributing and exchanging individual ideas (see Item 33 in Table 1), and 73.08% of students agreed that they were able to interact with their classmates for discussion and gaining new information (see Item 34 in Table 1). Besides that, collaborating on group project also stimulated students' communication and interaction in the process of planning and negotiating for tasks and work schedules, particularly 66.35% of students agreed that their group was able to make and follow a set agenda for working out the project tasks with their group members (see Item 36 in Table 1), and 63.46% of students agreed that they felt pleasant as they were able to organize their work more effectively than previous work (see Item 37 in Table 1).

4. Students were Oriented to Learning

The CMCL analysis for the students' communicative acts and their feedback showed that each of the domains and orientations in the model was useful to assess different conditions in students' learning process, and multiple perspectives were found. However, due to the page constraints, this paper only reports some significant perspectives. It can be noticed that when students were oriented to learning, they were able to share their knowledge and work together to solve problems for gaining more knowledge for project work. This is because they realized that they could become more knowledgeable when sharing or combining ideas from members, and then through solving problems together, students could find the solutions from different perspectives, hence better contents and outcomes could be developed (see cell A1 in Table 2). Besides, when oriented to learning, the students became more creative and dedicated to design several ways for developing ideas and making fair decision, including collect all feedback, and vote for the best during the meeting with members, as well as communicate with their members by using features in Facebook and sharing files through Dropbox cloud computing storage (see cell A2 in Table 2). In addition, when students were oriented to learning, they did not hesitate to share their experience and thoughts with others for increasing the mutual understanding. Students also realized that the process of gaining more mutual understanding were the important experience in enriching their thoughts in the learning process (see cell A3 in Table 2).

5. Students were Oriented to Achieving Goal

Besides oriented to learning, some students were oriented to achieving their goal. In this condition of learning process, their main concerns were about completing the task as much as possible based on the requirements, and then fulfill it through using various possible ways for obtaining good outcome. Hence it was found that there were cases where the students willing to work with some alternative ways in order to complete project tasks (see cell B1 in Table 2). As for the approach to ensure the completion for achieving the goal, the students then learned to delegate the task and set some rules, including based on own abilities, or voluntary basis as they worked together before. Occasionally, it was found that the students also used some other methods just to complete the tasks more efficiently (see cell B2 in Table 2). As for personal feeling and experience, the students felt good and proud when their aims or goals were achieved with successful outcomes. They also feel grateful and able to appreciate by their group members for maintaining the teamwork in achieving the goals (see cell B3 in Table 2).

6. Students were Oriented to Self-Representation and Promotion

The third learning condition is when the students were oriented to self-representation and promotion. They highlighted that their own skills had been enhanced through practicing in the project development process, and because of this, many student highlighted his/her ideas, materials, skills applied were the main contribution towards the project tasks (see cell C1 in Table 2). As for the way for self-promotion, the students took the chance to show their leadership skills and provide some instructions in the group especially for leading the direction and organizing the teamwork. In addition, the students did less or need not self-introduction as the members already knew each other prior to forming group (see cell C2 in Table 2). On other hands, the students also expressed their overall feelings towards their own performance and contributions, the most significant ones include the students felt quite motivated for being able to display their personal abilities and new skills, and throughout the entire process they were able to understand their own interest, strength and weakness (see cell C3 in Table 2).

Conclusion

In this study, the students learned to collaborate and communicate in a constructivist learning environment which centered at a problem-based multimedia group project. Students determined the selection of information based on prior knowledge, expectation and perceptions, then engaged in social negotiation to discover and formalize the solutions, as posited by Bruner (1990) and Cakir (2008). The survey result and analysis showed that by embedding web-based collaborative approach in the classroom learning, support and encouragement among the peers were strengthened, students' satisfaction and motivation gained in the learning process were enhanced, and students were more engaged to interact and communicate. On the other hand, the students' language acts which used to express their expectations, attitudes, and interact with peers were analysed by using the different dimensions in the framework of CMCL. The findings showed that students gained various experiences which bring the positive changes in the attitude for all dimensions and knowledge domains in the collaborative activities throughout the project development process. In all, the findings of this study provided deeper insights and more perspectives into the process of collaboration and communication in constructivist learning approach. As for the next stage of study, the research analysis can be advanced further for mapping the aspects found from the respective quantitative and qualitative data analysis. Therefore, the essential values can be explored on how students construct their collaboration and communication with their peers in the learning processes, particularly coming from different dimensions and domains. These new values will be used to develop a framework as a practical guide for Malaysian educators in order to better understand the level of student communication and interaction, so that more efforts can be made for sustaining and improve collaborative learning in technology-backed constructivist classrooms.

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Gazing into the future of Sri Lankan Higher Education: Capacity building for the future

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This paper reports on an investigation into capacity building processes in relation to e-learning resource development and delivery (RDD) in a Sri Lankan higher education institution. The capacity building was investigated in three main areas: strategic planning, institutional capacity building, and the resources acquisition processes. The project investigated the embedding of e-learning into the Sri Lanka Institute of Advanced Technological Education (SLIATE). Like many other higher education institutes SLIATE aspires to excel in providing quality teaching and learning facilities and quality learning experiences. The research project concentrated on the exploration of areas of capacity building within the academic community at SLIATE by identifying possible improvements to the management of e-learning RDD. The paper focuses on the findings in relation to the effectiveness of the capacity building process in e-learning resource development and delivery, and how this could assist SLIATE students with their learning.

Keywords: SLIATE, e-learning, online learning, learning technologies, capacity building, professional development

Introduction

This paper reports on the investigation of the capacity building process in relation to e-learning resource development and delivery at SLIATE. This was one case of a larger research project that set out to investigate how capacity building affects the management of e-learning resource development and delivery within three Higher Education institutions in Sri Lanka.

The SLIATE is one of the leading higher education institutes in Sri Lanka that provides post-secondary school education, and constantly investigates ways of increasing learning facilities for its students. The SLIATE, like many other educational institutes, strives for excellence of its teaching and the quality of learning experiences that it provides. The study investigated SLIATE stakeholder perceptions of their understanding of capacity building in relation to the management of Resource Development and Delivery (RDD) and how learners will benefit through the processes of implementing e-learning. It also addresses how the quality of teaching and learning in the institute is expected to change by building capacity to support e-learning within the main stream delivery model.

The Institution Context

The Sri Lanka Institute of Advanced Technological Education (SLIATE) was established under Act No.29 of 1995 (SLIATE, 2005). Prior to this the courses were conducted by the Technical Colleges which came under the Ministry of Labour and Vocational Training (Government of Sri Lanka, 2007). To overcome the gap between the Secondary Education, General Certificate of Education Advanced Level (G.C.E A/L) and Tertiary Education (Universities) and to fulfil the market demand, a separate institute (SLIATE) was established to provide both practical and theoretical knowledge (DEPP, 2006, SLIATE, 2005). After analysing the situation, it was recommended that a new institute would be established and developed and taught courses previously conducted by the Technical Colleges (SLIATE, 2005).

The main aim of SLIATE is to create middle level professionals who are equipped with the required skills to cater to the demands created by the local and international job markets. SLIATE provides professional courses to students who have not been selected to follow courses at the National Universities. SLIATE operates with a mission: "Education, Training and Certification of Competent Technological Personnel with Healthy Attitudes for National Development" (SLIATE, 2005).

According to the 2007 Asian Development Bank (ADB) proposal, SLIATE is expected to award National Diploma (ND) and High National Diploma (HND) level qualifications for mid-level engineering and business professions (ADB, 2007a; Government of Sri Lanka, 2007). For this purpose, the ADB proposed creating policy on tertiary education and revising regulatory frameworks for long-term reforms (ADB, 2007a; Hanna, 2008). The proposal also indicated that one of the needs of a medium-term strategy is to strengthen the capacity of existing institutions such as SLIATE, to meet immediate demands (ADB, 2007b; ADB, 2008a). The government is supporting SLIATE, along with international aid to develop distance education and e-learning to deliver courses (Government of Sri Lanka, 2007). With a great history and government funding, moving forward aligning to the ADB recommendation was an important step forward for the institute (Gunawardana, 2005; Hanna, 2008). SLIATE caters for a wide variety of learners with diverse learning styles and capabilities (DEPP, 2006).

The institute has been offering several Higher Diploma and National Diploma courses (SLIATE, 2005). These courses are delivered under government directives. The main tasks at the moment are to build the necessary infrastructure and build capacity to up-skill staff and begin courses using e-learning. To fulfil this requirement management has established a process for the application of grants in order to acquire the necessary infrastructure. Some examples of the grants are: the World Bank project, Improving Relevance and Quality of Undergraduate Education (IRQUE) for quality enhancement in education; the DEMP National Online Distance Education Service (NODES) project; Higher Education for the Twenty-first Century (HETC) (ADB, 2008b; DEMP, 2005; DEPP, 2005). The time-consuming tasks such as applying for grants, managing the projects and similar initiatives were supported by management in an attempt to provide better learning opportunities for students.

The Institute has been identified as one of the major potential users in distance and e-learning in Sri Lanka by ADB (ADB, 2008b; DEPP, 2006). Due to this identification and the support offered, the Institute has taken the initial steps in launching their courses in an innovative manner, and educating management and the academic staff regarding the technological developments which support online and blended course delivery.

Methodology

The research focussed on an in-depth investigation of higher education institutions in Sri Lanka, specifically examining the areas: strategic planning, capacity building and resource acquisition.

Merriam (2002) indicated that qualitative studies have high capabilities when gathering in-depth information. The process of data collection in qualitative research depends mainly on the requirements of the research. This research heavily depends on the personal experiences, attitudes, and feelings of the participants which require the use of descriptive information. Therefore, interviewing was considered to be a suitable data collection process as opposed to a survey. Further, Sarantakos (2005) stated that observations entail the systematic noting and recording of events, behaviours, and artefacts in the social setting chosen for study. Hence, appropriate data collection methods to gather information for this research were considered to be the interview followed by focus-group discussions and observation methods. Further, discussions were arranged with some consultants at a variety of funding organisations such as: the Asian Development Bank (ADB); and the Japan International Cooperation Agency (JICA) in order to gain an insight into the management and activity of e-learning RDD.

Merriam (1998), Guba (1999) and Neuman (2006) discussed how interviews are classified according to the structure: highly structured interviews, semi structured interviews and unstructured interviews. Among the above mentioned, highly structured interviews rigidly adhere to predetermined questions and do not allow the researcher or the investigator to access participant's perspectives and understandings. On the other hand, the open-ended or unstructured interviews assume that individual respondents define the world in unique ways. This method was found to be useful in situations where the investigator did not know enough about a phenomenon. On the contrary, semi structured interviews facilitated the implementation of interviewing within the boundary of the research, and were therefore flexible enough to investigate new findings. Considering the research aim, it was found that semi-structured interviewing was the best methods to employ for gathering data. A few questions were designed to find out participant demographic information, with sixteen specifically open-ended questions asked to gather other information about e-learning RDD management.

Patton (1990) further states that selection through convenience sampling is not credible. However, Patton (1990) discussed convenience sampling, and stated that it is selected based on the time, money, location, and availability of the sites or respondents. The participants were selected from different departments from the one centre within SLIATE. SLIATE has branches across the country, however the political situation and unstable war environment in the country when selecting the samples, participants in the Northern and Eastern parts of the country, were not selected due to the inconvenience of reaching the participants. The main city campus in Colombo (Capital of Sri Lanka) was selected for this research study. This was justified since it is the city campus that leads the other branches and their operations. Further, observation sessions were conducted to learn the nature of the organisation's activity flow. Focus group meetings enriched the findings by accumulating multiple views into the data set.

The intention of this research is to identify the capacity building processes in relation to e-learning RDD within the higher education institutions in Sri Lanka. The participants are the key resources from where these processes and practices are gathered. Grounded theory, in qualitative study, facilitates derivation from the data, of a theory that is grounded in the data (Denzin & Lincoln, 1994). Grounded theory emphasises discovery with description and verification as secondary concerns, making substantive evaluations (Merriam, 1998, p. 17). In this research, the data gathered requires analysis via a constant comparative method of data analysis, to gain an insight into current management practices within HEIs in Sri Lanka. Unlike hypotheses in experimental studies, grounded theory hypotheses are tentative and suggestive rather than tested. Strauss and Corbin (1998) compare this methodology with other approaches to qualitative research, noting that a major difference lies in the commitment to theory development and theory verification. Further, considering the nature of this research, and what the research intends to investigate and the strengths of grounded theory, it was selected as a data analysis approach rather than a research method in this study. Grounded theory was used to proceed with the research to identify the emerging themes.

SLIATE was studied, with detailed investigations into the possible improvements that could assist with the goal, thereby providing better experiences for those learning. In addition, several other institutional developments were studied to identify how e-learning was embraced into the mainstream course delivery within the Sri Lankan context.

Findings

Strategic planning

It was found that even though there was a great need to move to online learning and the use of technologies to deliver courses, SLIATE was still in the initial stages of project planning in undertaking e-learning RDD tasks. It was found that in the past there were limited specific strategic plans towards e-learning or online learning. With the current support and initiatives, it allowed the knowledge base to be enhanced, and teacher contribution and involvement to be increased through participatory capacity building.

However, the participants' responses about reward schemes that were currently in place raised concerns. The findings showed that current reward schemes only assisted face-to-face RDD processes, and the need for e-learning specific reward schemes was highlighted. The policies and procedures only catered for a face-to-face delivery model, and the current mode was a traditional, legacy system that was established a long time ago.

With a constant comparison of their reward system to that of the government reward system and that of many private vocational education institutions in Sri Lanka, the participants showed how important it was to have new e-learning specific strategies. With discrepancies in several areas, including professional development opportunities, paper marking, overtime and other rewards, the staff felt that their work would be of more value in engaging other staff and motivating them through a new reward scheme. Other staff suggested that they gained rewards through other means, that is self-satisfaction, which could not be measured in monetary terms.

Institutional capacity building

The initial planning and research for professional development was underway. The leaders were planning professional development strategies and making plans to provide necessary resources for the academics within SLIATE. Several long-term (masters programmes) as well as short-term training was offered to the academics via the projects IRQUE, ADB and Higher Education for the Twenty first Century (ADB, 2008a; IRQUE, 2009).As the concept of e-learning was new to this Institute, it was found that leaders were seeking assistance from the academics to build the plan, identify required resources, training and other components. A participant mentioned that:

> *"We have been asked to find the training that we would like to attend by our leaders. It is still in the initial stage but we also feel responsible and motivated when we are given the opportunity to contribute and participate in the planning phase*"

In this process the management guided staff by inviting them to be part of the project and requesting them to contribute to identify the areas that interested them in the online environment. Staff were also requested to investigate different professional development programs that they would like to attend in their expert area as well as ones specific to e-learning. The participants felt that the process would reap major benefits, as their subject specific input/recommendation would be taken into consideration when planning a major change over, such as moving into online learning.

Due to current limitations the staff felt more comfortable having face-to-face discussions rather than using email or other tools. Occasionally staff conducted meetings to discuss more general matters. During the observations, amazing graciousness was found within the institution as to how helpful staff were to each other, the sharing and caring nature of staff, and how work-related issues were addressed in a professional and responsible manner. A clear knowledge-sharing culture was observed within the organisation, while this process enabled enthusiastic academics to proceed forward and assist the other academics.

One of the key elements of research investigated was whether capacity building through professional development encouraged staff to be involved in the new teaching environments (Khan, 2005). It was found that the "Computerised Accounting professional development" session that the participants had undertaken had been extremely useful, and would assist in their teaching. These professional development sessions have equipped the academics with the latest techniques in accounting which will enable them, as well as their students to be up-to-date in the use of the latest techniques required by the industry. It was mentioned:

> "*These professional development sessions help us to trigger and develop our own thinking and help us to teach new things to students that relate to the industry requirements."*

Professional development sessions were held depending on the department's requirements. Some departments conducted professional development sessions as often as four times a year, while other departments assisted with their professional development sessions, ensuring they were based on necessary requirements. Another department arranged professional development sessions for staff by getting external consultants during the academic break.

It was found:

> *"These sessions are very helpful and allow us to re-think what we practice in these teaching environments"*

Acquisition of resources

Based on the data provided, and the observations it was identified that SLIATE is not a technologically resourceful institution. With a limited number of computers, its capacity to participate in the online resource development activities was restricted; Staff shared the few computers available for resource development tasks.

At times staff used the computers located in the laboratory which were common to both students and teachers. Due to accessibility difficulties, staff members were restricted when using technology-based tools on a daily basis, even simple things such as emails. This indicated that for an online learning environment to be successful the institute required a change over with large investment in equipment and resources.

The English Language department had requested resources for a language laboratory which they needed for their course delivery. They had also requested resources such as software, computerised accounting resources and similar teaching and learning resources. The participants showed great interest, motivation and excitement about the project and were responsible for making the changes necessary to support the goal of providing education for the larger community.

The Accounting department was looking forward to purchasing computerised accounting software that they did not currently use for any of the courses, even though it had been a requirement for a considerable period of time. This new sudden awakening was due to the initiation of applications for grants to become digitally ready academia. These capacity building plans have triggered enthusiasm amongst several academics as well as administrative staff. Few staff members had taken the responsibility of initiating these projects at SLIATE. However, there were many dependencies, and for a positive forward movement the initiative required support and a management contribution.

It was evident that a new culture was building within the institute; the leaders were supporting the initiators and giving them the authority to be involved in these innovative projects, in order to enhance teaching and learning with the use of technology.

Gazing into the future

Since this Institute is in its initial stage, there were a number of identified future plans that needed to be completed. These involved the Institute building capacity in the identified three areas: strategic alignment, capacity building and acquisition of required resources including infrastructure.

Strategic plan

The institute had a strategic plan and many staff were aware of this plan. However, this strategic plan only focused on the institution's general strategic requirements. In relation to e-learning it stated that the Institute should provide quality education. This point was expanded upon by staff to set-up e-learning facilities which would provide higher education to the students. However, the government's interest in providing higher education to students who did not have access to the universities, added value to this idea. The Distance Education Modernisation Project (ADB, 2008b; DEMP, 2005) also focused on providing support to students to enhance learning, especially through institutions like SLIATE. In order to progress it was found that more specific details related to e-learning needed to be incorporated into the strategic plan.

There are several policies and procedures related to institution management which have been developed through standard government policy and procedure manuals. These policies and procedures were mainly related to purchases, payments, student registration and examinations. With regard to education, the policies related to daily activities for traditional face-to-face course delivery. New policies and procedures needed to be developed in relation to an e-learning RDD environment specific to the institute. One of the leading e-learning providers in Sri Lanka, University of Colombo School of Computing (UCSC) has developed their institute specific, e-learning focused strategies that have assisted them to progress to be progress well in the area (De Silva, 2011). Similarly, these new policies and procedures would need to address areas such as payments and cost covering tasks, time and workload allocation, quality evaluation procedures, development and delivery procedures, and rewards. It was also evident that staff required clear instructions, work ethics and procedures, which needed to be very specific and clear within these new processes (Latham, 2009). To have more participation and contribution, clear instructions were found to be vital.

Institutional Capacity Building

The introduction of e-learning and capacity building through professional development had created a new ideology within the institute. This was related to the work allocation, workload, enthusiasm and authority. Many of the staff who were willing to spend their time and energy on these activities were self-motivated. It was also identified that the staff require time and training to be confident with innovative resources (Keppell et.al , 2005). Many leading higher education institutes in Sri Lanka, require e-learning specific strategic plans that focus on work allocation and reward systems related to e-learning course delivery and resource development (De Silva, 2011). Similarly, SLIATE is in need of e-learning specific processes and procedures with the development.

There are many plans to provide quality infrastructure for staff to carry out e-learning RDD tasks (Hanna, 2008), training time and specifically, reasonable payment schemes. With the new proposed policies and procedures it is envisaged that staff members will find it easy to adhere to any specific policy or procedure emphasising tasks and to becoming ready for online learning environment. The change management process with necessary resource allocation will support an easy change over (Kotter, 1996).

Resource acquisition

During past years, by utilising the funds of the donor agencies SLIATE has been able to upgrade its infrastructure facilities, such as Audio visual rooms, language labs, modern furniture computers, and computer software, further they have been able to update their curricula and libraries with some of the recommended texts. Similar to Hanna's (2008) suggestions, the majority of funds have been allocated to empower the trainers through capacity building. Several higher education institutions in Sri Lanka such as Open University of Sri Lanka and University of Colombo are progressing in developing their infrastructure through different funding projects (De Silva, 2011). Similar to the other higher education institutes SLIATE is also progressing with their resource acquisition tasks.

Three new Advanced Technological Institutes (ATIs) will be established under the Higher Education for Twenty First Century project (Tangalle which has completed construction, and Vavunia and Ratanapura which are partially constructed) plus six existing ATIs will be upgraded with their facilities.

Future plans

The Institute has been able to identify the potential demand in the environment and introduced several new courses/programmes in the last two years (Tourism and Hospitality Management, Quantity Survey Building Construction, Food Technology). These improvements have supported the developmental process.

The target has been set to share all of the programmes' materials amongst the ATIs by 2014, using a free and open source Learning Management System, Moodle. This will be a major step forward for the institute in providing an online learning presence which will cater to a larger student cohort.

SLIATE, having eleven Institutes in the country and a common curriculum and evaluation, is observed to have uniform teaching. With the update of the new LMS, Moodle it is expected to share learning resources and facilitate uniformity among institutes across campuses and courses. As an initial step, the information technology academic staff (HNDIT) has begun introducing learning resources within Moodle for their academic staff and students, with the intention of expanding to other courses.

Summary and Conclusions

The investigation found key criteria that will assist SLIATE to proceed with embracing innovative and technological approaches to learning and teaching. It was found that the key themes which emerged were categorised under: strategic direction, capacity building and infrastructure. Policies and procedures, and staff incentive schemes were highlighted as important areas that needed to be addressed within the institute strategy, while the change management took place to motivate and sustain the interest in the new invention. Individual staff contribution either as managers or academics was also considered to be an important factor in achieving success. It was found that change management process needs to be factored into capacity building to support staff to be confident and successful. It was also found that acquisition of resources alone does not

By developing and publishing a strategic plan for e-learning specifically focussed on learning and teaching, the Institute will be able to maintain high quality e-learning activities. It was also found the procedures and policies will re-align responsibilities to carry out e-learning RDD in a more organised manner.

The SLIATE has progressed well with the initiative embarking into the area of e-learning. With strategic directions and support from internal and external organisations, such as government of Sri Lanka, international funding organisations such as ADB, DEMP, IRQUE; SLIATE is progressing with the development plan. The Institute is also progressing with building their infrastructure with the funding that they are receiving, while providing different professional development opportunities to staff.

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Issues Integrating Remote Laboratories into Virtual Worlds

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Laboratory work in education has long been recognised as providing real benefits to students. Increasingly, remotely accessible laboratories are being used for laboratory work in the sciences and engineering, providing students with remote access to real equipment while delivering additional benefits to institutions. There is an increasing focus on how these labs may improve laboratory learning outcomes. One potential enhancement, resulting from their mediated interface, is the ability to add contextual information to a laboratory activity. Virtual worlds have been identified as a rich environment for providing contextual information. However, the reported examples of real equipment laboratories integrated into a virtual world are specific to the laboratory. This paper describes a more generic approach to interfacing a virtual world, Open Wonderland, to laboratories which use the MIT iLabs platform. The paper reports on the issues involved in the interface and the strengths and limitations of this system.

Keywords: Interoperability, Laboratory, Remote, Virtual World.

Introduction

Remote laboratories are increasingly in use throughout the world providing students remote access to real equipment (Lowe, Murray, Lindsay, Liu, & Bright, 1986). These labs are mediated through a computer interface, providing an opportunity for educators to manipulate the environment in which students perform labs. It has been argued previously that adding domain specific contextual information to a laboratory activity has the potential to improve students understanding of how the laboratory relates to the real world (Machet, Lowe, & Gütl, 2012). Three-dimensional virtual worlds have the facility to provide an environment for adding contextual information while preserving the authentic experience of working on real equipment.

This paper presents a technical solution for remote laboratory integration into a virtual world, specifically an iLabs based lab incorporated into Open Wonderland. The paper describes the state of virtual world and remote laboratory integration in the literature, presents an overview of the iLabs architecture and the development environment for Open Wonderland and describes the system we are aiming to develop. Alternative solutions are described and the final solution for interfacing the iLabs components and Open Wonderland platform is presented. Design issues that affect the selection of the solution and the relative merits of the chosen approach are discussed, and conclusions are drawn and suggestions made for future work.

Background

There is currently no single standard for the development of remote laboratories. Rather, there are a number of different architectures that have been developed to meet various pedagogic needs, diverse philosophical approaches, and specific technical laboratory requirements. In addition to single use remote labs, there are a number of platforms that have been developed to provide students with access to a variety of laboratories, such as Labshare's Sahara platform, or MIT's iLabs platform.

For the research reported here, the iLabs platform has been selected for the initial work as there has already been some development into providing new interfaces into the iLabs experiments (Payne & Schulz, 2013). Additionally it is hoped that developing a solution for a widely used remote lab platform will allow the integrated system to be expanded for use with a number of different labs for future work.

There are a number of affordances of virtual worlds described in the literature, such as the ability to collaborate, which are advantageous to remote access laboratory work (Dalgarno & Lee, 2010). One such affordance is the ability to contextualise an activity by providing additional information in the form of the virtual world surrounding. This has been used in teaching in a number of laboratories, where activities within the immersive virtual world are part of a story that provides the user with contextual information to be used in completing the activity and applying the knowledge to areas outside the scope of the lab activity (Pringle & Henderleiter, 1999). Examples such as Puget Sound laboratory (Windschitl, Winn, Education, Box, & Wa, 2000) and Virtual Chocolate Factory (Back, Kimber, Rieffel, & Dunnigan, 2010) use custom developed virtual worlds, while other lab activities have been set in existing virtual worlds such as Open Wonderland and Second Life ("Circuit WarZ," 2010; Scheucher, Bailey, Gütl, & Harward, 2009).

Research into which virtual world best meets educational requirements does not provide a stand-out candidate for all learning in virtual worlds; rather this depends on the nature of the learning activity and which virtual world affordances are being exploited. While no platform meets all of the requirements for the integration a remote lab into a virtual world, a few such as Open Wonderland, Second Life and Open Sim could all be argued to be suitable (Kaplan & Yankelovich, 2011; Smith, 2009). Previous investigation has led to the selection of Open Wonderland for this project primarily because it is open source, cross-platform, requires no proprietary software development and importantly supports multiple language plug-ins and application sharing so existing remote lab interfaces can be easily re-used (Machet & Lowe, 2012).

Architecture

iLabs

The iLabs platform is a remote laboratory sharing platform developed at MIT with the aim of sharing laboratory resources in various geographical locations with students and institutions across the world. The aim was to develop a scalable system that provided for easy deployment of new labs (Harward et al., 2008). iLabs at a basic level consists of a Lab Client which provides the interface through which the user creates and submits an experiment specification, and a Lab Server which handles the validation and submission of an experiment from the Lab Client via the Service Broker and runs the experiment on the equipment. Messaging between the Lab Server and the Lab Client are passed through a Service Broker using SOAP calls. (Payne & Schulz, 2013).

Open Wonderland

Open Wonderland is an open source virtual world developed by Project Open Wonderland. Among the main goals of the Open Wonderland developers was the provision of an extensible toolkit based on open standards to enable easy development (Kaplan & Yankelovich, 2011). Open Wonderland has a modular client-server architecture developed in the open source Java programming language.

The Wonderland toolkit allows developers to extend Open Wonderland at a number of different "extension points". A common extension is new *object types* referred to as *cells* which can have client-side and server-side behaviours. Open Wonderland provides the infrastructure to create and add new modules, where new cell types can be developed and compiled. There are also a number of existing modules in the Open Wonderland Module Warehouse that can be used, such as video streaming. Currently there is no SOAP module for Open Wonderland, but there are a number of solutions for external communication, such as a module that provides an example of a RESTful API to a web service (Flores, 2011).

Integrated System

The integrated system will need to be developed to interface Open Wonderland to the iLabs Lab Server so that students who are within the Open Wonderland world can access the remote laboratory controls and execute the lab. This means that the Lab Client and Service Broker functionality of the iLabs system must be implemented for use within Open Wonderland.

A solution will need to be found for how this Lab Client and Service Broker functionality can be developed in Open Wonderland using Open Wonderlands scripting, cell behavior and add-on modules, or accessed from within Open Wonderland using existing functionality such as X11 application sharing or a VNC viewer. Effectively, Open Wonderland would appear to any iLabs Lab Server as a generic Service Broker.

Lessons

Solution Alternatives
In order to interface between Open Wonderland and iLabs, we can look at the solutions from the point of view of the level of integration of iLabs Lab Client and Service Broker functionality into Open Wonderland. In this case, in increasing order of integration the following solutions are proposed:

1. **External functionality**. The Lab Client and Service Broker functionality can be realised externally to Open Wonderland. Access to the Lab Client will then be through either the Open Wonderland VNC viewer module capability, or X11 application sharing, depending on the nature of the interface. This solution would require a small amount of development in Open Wonderland and make use of existing components in iLabs and Open Wonderland; however the integration of the control interface within the contextual elements to be added to the virtual world would be limited. Additionally, this system would be most affected by latency in external communication. Scheucher 's (2009) integration of an iLabs based force on a dipole laboratory into Open Wonderland provides an example of this type of integration using a VNC viewer to access the Lab Client which was a LabView interface to the force on dipole equipment.
2. **Partially integrated functionality.** A second option would be the development of the Lab Client functionality within Open Wonderland so that all laboratory controls are developed within Open Wonderland. In this case, the Open Wonderland Lab Client would communicate with a modified Service Broker through exiting communication channels (for example dedicated sockets or the Open Wonderland RESTful API). The Service Broker functionality would sit outside of Open Wonderland and be modified to accept information from the Open Wonderland Lab Client. This option requires significant development but is based on the ability to use tested Open Wonderland interfaces to external services. This solution will allow new labs to be implemented in Open Wonderland requiring only Lab Client development and providing the ability to re-use the new Service Broker.
3. **Wholly integrated functionality.** As a third wholly integrated option, both the Lab Client and Service Broker functionality would sit within Open Wonderland. In this case, the Lab Client controls would be implemented in Open Wonderland, and inputs from this would be used to provide information for the SOAP interface to the Lab Server. The SOAP client would need to be developed as a module for Open Wonderland. This option allows the most integration of components within the virtual world. It eliminates the need for a separate Service Broker, but also requires a large amount of development (particularly the SOAP module for Open Wonderland) and the solution will be more specific to the laboratory, requiring additional re-work for future lab integration.

Proposed Solution
The second option (with an integrated Lab Client, external modified Service Broker) has been selected as a basis for this research, as it provides a compromise between a generic solution that can be used with any laboratory, and a specific solution that allows all the features of the lab control to be well integrated into the Open Wonderland environment. Additionally, it is a compromise between being able to re-use existing code (such as already developed laboratory interfaces and the existing Service Broker) and a customised solution.

> **Lesson 1:** Bounded extensibility of the integrated solution is achieved through limiting the amount of laboratory specific development. New laboratories will require new in-world control interface development.

Development for this solution is made up of three parts: The Lab Client functionality within Open Wonderland, the interface between the Open Wonderland Lab Client and the new Service Broker, and the development of the modified Service Broker as illustrated in Figure 1.

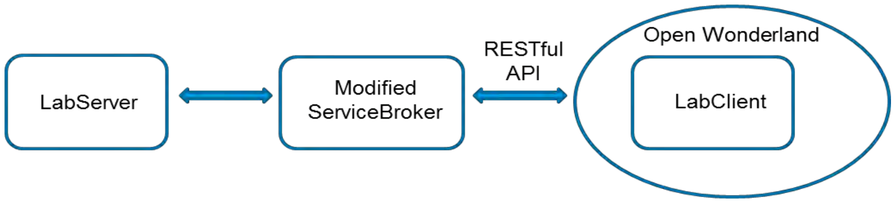

Figure 1: Proposed solution architecture

The Lab Client will consist of the experiment interface that the user will see when conducting the experiment. The interface controls will be developed 'in-world' and be integrated with the contextual elements in the virtual world. The interface will include a video feed of the laboratory for establishing the reality of the equipment. The Lab Client will need to pass the correct experiment information to the Service Broker which can then interface to the Lab Server.

> **Lesson 2:** Coherent integration of the laboratory control interface into the virtual world requires redevelopment of the control interfaces. The result will be that additional development effort will result in a logically presented control interface and improved latency.

The Service Broker functionality in this case will be to provide the authentication information known to the Lab Server in order to execute the lab. Development will require the modification of a Service Broker to accept the new format of inputs from Open Wonderland (using a RESTful interface).

> **Lesson 3:** External communication from the virtual world can be achieved through a suitably defined RESTful interface. Information from the virtual world can be communicated to an external web service, and the responses can be used to manipulate elements within the virtual world. This interface component will be useful in integrating future labs.

This option eliminates the need for a SOAP module to be developed for Open Wonderland, and makes use of existing external communication capabilities.

Discussion and Conclusions

The solution proposed here involves developing Lab Client functionality within Open Wonderland and a modified external Service Broker. The solution will require a significant amount of development but it does make use of existing components of the iLabs and Open Wonderland platforms such as the available Open Wonderland external communication module. The modified Service Broker and ServiceBrokerAPI functionality proposed will be available for re-use if new labs are included in Open Wonderland in the future.

This solution is an improvement over the using a VNC viewer (or X11 application sharing) to visualise a Lab Client outside of Open Wonderland, as there will be less latency between avatar actions and the control interface if the control is developed within Open Wonderland. However, the solution will require redevelopment of a control interface that already exists in many cases. An advantage of the chosen solution is the ability to integrate the control interface better into the virtual world, rather than being limited to the VNC viewer cell.

This paper has presented a technical solution for the integration of iLabs functionality into Open Wonderland. It offers a realisable solution that presents a reasonable compromise between re-use of existing components, development effort, extensibility and customisation. The solution proposed here allows for the development of a new remote laboratory environment that has the potential to be used for further research and learning.

The next steps in this research are to implement this solution and determine whether the integrated virtual world and remote laboratory system meets the functional requirements for future research to be carried out, particularly into the possible effects of adding contextual information to laboratories. Future work in this area could involve extending research into a number of different remote laboratories and laboratory learning outcomes, such as the effects of collaboration on remote laboratory learning outcomes.

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An online professional network to support teachers' information and communication technology development

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This paper reports on an evaluation undertaken of the potential impact of a Network for Educators: the Pathways for Learning, Anywhere, Anytime (PLANE) website. The evaluation was undertaken in New South Wales, Australia with teachers in Government, Catholic and Independent schools in both rural and suburban areas. The benefits and challenges associated with supporting teachers' information and communication technologies (ICT) skills via a professional learning network platform are highlighted. Results of the study indicate that a well-designed online platform could potentially provide a space for teachers to learn to integrate ICT in their teaching with and from each other within a learning community.

Keywords: CoPs; online communities; teachers; professional development

Introduction

Educators today are faced with the challenge of fostering students' ability to prepare themselves for an unknown future, one that will involve the effective use of information and communication technologies (ICT). In order for teachers to be able to educate their students, they themselves need to be equipped with skills in using and teaching with ICT. In response to the need to develop the ICT capabilities of teachers in New South Wales (NSW) Australia, the Pathways for Learning, Anywhere, Anytime–a Network for Educators (PLANE) website was developed in late 2011. The project was funded through the Australian Federal Government's Digital Education Revolution ICT Innovation Fund.

This paper reports on the potential impact the PLANE website might have on the innovative use of ICT in pedagogy, specifically in terms of enhancing the capacity of teachers and leaders to develop the pedagogical understanding, confidence and the tools required to design and deliver curricula that effectively enhances student learning outcomes. In carrying out this evaluation, interviews, case studies and surveys were utilised.

The key question driving the evaluation was: What is the potential impact of PLANE on the innovative use of ICT in pedagogy?

Teachers' online professional networks- a review of the literature

It is clear from the literature that teachers are participating in many varied online professional networks organised both formally through associations and informally through sites like Facebook. Each of these sites offers something to teachers that support their professional needs. Participation in networks has many benefits but there are also many challenges in setting up and sustaining them.

Teacher professional networks have been in existence for many years. These networks usually involve "voluntary, reciprocal interactions among teachers that enable teachers to share or acquire the professional expertise that strengthens service to students" (Adams, 2000, p. 19).

Participation in informal social networks can be a powerful catalyst enabling teachers to improve their practice (Schlager & Fusco, 2003). One of the main reasons for participation in informal social networks is that it fulfills a teacher's immediate needs or desires. "This ''just-in-time'', as opposed to ''just-in-case'', need-to-know basis can transform teachers into active knowledge builders possessing substantial autonomy regarding the specific knowledge they require (Granger, Morbey, Lotherington, Owston, &Wideman, 2002)" (p. 574).

One of the benefits of online networks identified was their ability to reach teachers regardless of where they live and work (Thomas, 2004). This gives teachers access to information and resources when needed. Some teachers have referred to this as help as 'only a click away'. Physical barriers to access are removed, allowing 'anytime, anywhere' and 'just-in-time' learning to occur.

In order to encourage teachers and school leaders to engage in professional online networking it is important to provide teachers with the tools with which to undertake this. Teachers need to be provided with up-to-date devices so that they can engage in online training anywhere and anytime. The provision of these computers should also come with professional on-site technical support and the ability for teachers to download software as they see fit to support their online networking. Currently this occurs in NSW Government high schools, but not in the primary schools. Nor is it uniformly done in the Catholic and Independent sectors. Until it is, teachers cannot readily be expected to engage in professional networking in their own time using their own resources.

Methodology

The evaluation of the potential impact of PLANE comprised two phases: The first phase was conducted between November 2011 and April 2012. The second phase took place between May 2012 and September 2012.The purpose of both phases of the evaluation was to explore PLANE's potential. This was achieved through interviews with individuals and groups who were directly involved in managing or advising the development of PLANE, analysis of documents related to the project and observation of early PLANE prototype trials. In the second phase, data were collected from in-service teachers and school leaders through surveys, interviews and analysis of case studies. It is the results of Phase 2 that inform this article.

Results and discussion

The majority of the teachers interviewed had some leadership role in the school, often associated with ICT. All the teachers interviewed were highly enthusiastic about PLANE and could see great potential once the site was fully developed. The majority of teachers interviewed were the only ones using PLANE in their school and they had usually heard about it or seen it generally through their existing professional networks or at meetings. It was because these teachers were early adaptors that they were chosen for the research project.

A number of themes relating to the use of PLANE as an online networking tool emerged through analysis of the data are discussed below:

Professional learning

The teachers were asked if they felt they received enough professional learning opportunities in relation to ICT. Over 50% of respondents felt that they were not receiving enough training at the school level, which does indicate the importance of web environments like PLANE.

There was a mix of ideas in relation to the professional learning opportunities of PLANE. All the teachers interviewed felt that the opportunity for being accredited by the NSW Institute of Teachers (the NSW teacher accreditation body for teachers in NSW) for professional learning in PLANE was highly desirable.

The rural teachers interviewed were very enthusiastic about the opportunity for professional learning through PLANE due to their limited opportunities to attend professional development workshops in person. The ongoing professional development for teachers is challenging and a lack of it can have a negative impact on early career teachers in rural areas (Herrington & Herrington, 2001).

Many of the metropolitan teachers stated they had adequate professional development opportunities through their school and did not place a high value on this aspect of the site although they felt this would be a good opportunity for early career teachers. One teacher stated that the 'no charge' nature of the site made it attractive for professional development, particularly given the cost of professional development courses plus the cost of a replacement teacher.

Cross-sectoral feature

The fact that the site is an initiative of DEC, the Independent and Catholic systems was viewed as favourable by around half of these teachers. They felt this gave the site more credibility. According to one participant: "*the cross systems, bringing together Public, Independent, Catholic, it is way overdue, it brings people together for the right reasons*." A number of the teachers attend TeachMeets where there is a cross-sectoral approach and saw some compatibility between PLANE and TeachMeets.

Every teacher interviewed already had a rich online professional network. Ozedmodo, Twitter and Yammer were the three main sites to which participants referred. They all felt that PLANE had something different to offer and that a number of contacts from the three sites mentioned were also members of PLANE. One teacher commented that many teachers in his school do not network outside of the school. Another teacher suggested many teachers like to download and get resources, but many do not upload or provide resources. Judging from the comments, participants would continue to use the other sites in conjunction with PLANE.

E-portfolios

e-Portfolios offer a new way of collating and displaying information (Hills, Randle & Beazley, 2010). Respondents found the PLANE e-portfolio module beneficial in different ways: supporting the integration of ICT into the classroom, organising resources and information, and encouraging reflection. Participants also felt that creating a portfolio on this site may be safer as opposed to a commercial website which could close down meaning all the work would disappear. The site also has more credibility as it is an initiative of the education sectors. Having an eportfolio on the PLANE site was viewed as beneficial as this would allow teachers (particularly early career teachers) to be seen by potential employers and would increase their employment prospects. One participant felt the design of the eportfolio could be more clearly linked to the New South Wales Teacher Institute outcomes.

Building a learning community

One of the important features of any network, whether it is online or face-to-face, is that participants have a sense of community. However, when asked if they linked to other teachers on PLANE, not all teachers said they attempted to contact teachers while on PLANE. Of those that did, the majority found that it was easy to link up with other teachers. This ease of use is important in helping to build a learning community.

It was noted that during the interviews and case studies that the PLANE site contributed towards building a community by augmenting face-to-face interactions, which occurred in two different ways. Firstly, a number of the teachers we spoke with belonged to a professional organisation and some of these members joined PLANE so there was an existing community which was then developed further on PLANE. Secondly, some teachers met each other at TeachMeet events and through this they were able to then link up with each other on PLANE and continue to build the community online.

The PLANE site has the potential to allow teachers to engage in activities and conversations over time on topics that they are interested in, rather than one-off sessions mandated by the school. These one-off sessions have not been found to be successful (McCornell, Parker, Eberhardt, Koehler &Lundeburg, 2012). Allowing for sustained and focused interactions within a learning community is a critical design feature of the PLANE site.

Design of the site-ease of use

What constitutes a good web site design has been traditionally explained by relating it to usability. "In other words, a successful web site generally refers to one with high usability, which is user-friendly and user-centered in interface and functional aspects" (Lee & Koubek, 2010, p. 330). In the survey, respondents were asked to report whether they had experienced difficulty when attempting to use PLANE. Respondents indicated that they experienced some difficulties accessing PLANE. The three most frequent difficulties were that some functions did not work correctly, navigational difficulties and uploading files.

It should be noted that the site was under development throughout the evaluation period and that the navigation issues were being taken on board to ensure that the site was as intuitive as possible. Whilst there were some difficulties reported - some of which were outside the control of the site (eg. internet connectivity), 35 respondents reported having no difficulties with the site at all.

Conclusion

The design of the site brought the three sectors of education (Independent, Catholic and Government) in NSW together. The ability to bring together pre-service teachers, in-service teachers and school leaders is also another innovative design feature. The PLANE site allowed teachers to interact with other and content along the continuum of their professional careers from pre-service teacher to leader.

Providing accreditation from the NSW Teachers Institute those teachers who undertook activities online was also an important feature of the PLANE web site. This feature is particularly important for early career teachers who are required to undertake 100 hours of training over five years. In considering the design features of professional learning websites, it is not only the navigational aspects that are important, the pedagogical design features are also equally important.

It was clear through discussion with teachers that PLANE was one of a number of sites that they used to support their professional development. The importance of a vibrant online learning community to support the professional development of teachers so that it is 'just in time' as opposed to 'just in case' is critical if teachers are to develop ICT skills to support their teaching. The features built into PLANE offer the opportunity for this to happen although some participants suggested additions that would add extra opportunities such as chatrooms to extend the potential to develop a learning community. This challenge to improve capabilities of the web site is open to the developers of the web site. It was determined from this evaluation that the PLANE online environment could potentially have a positive impact on the innovative use of ICT in pedagogy.

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Does the use of the TPACK model enhance digital pedagogies: We don’t understand the present so how can we imagine the future?

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This paper reflects on the use of the TPACK model in e-learning courses to enhance students’ ability to use technology in their learning and later in their professions and to introduce the concept of *digital pedagogies*. To maximize students’ learning, this model was disseminated in the design of the course, the learning activities and the assessment. The aim was to encourage students to become reflective learners and to create knowledge collaboratively. Different technological tools such as iPads, ePortfolio together with *digital pedagogies* were used to enhance the students’ learning experience and obtain students’ reflections and feedback on the unit. *Digital pedagogies* refer to teaching–learning approaches in which new technologies change the way we teach. From the thirty postgraduate students in the unit, there were different responses to digital pedagogies. Some felt it transformed their learning while others resisted and did not participate in the interactive spirit of the class.

Keywords: e-learning, TPACK model, digital pedagogies, collaborative learning

Introduction

As the world becomes more connected and work more collaborative (Johnson, Adams & Cummins, 2012), the impact of new technologies on teaching requires a pedagogical shift. My goal as an educator is to integrate technology, pedagogy and content knowledge (TPACK) (see Figure 1) to maximise learning. Therefore for many years, I have developed innovative pedagogies using new technologies to encourage students to become active and reflective learners and to create knowledge collaboratively (Maor, 2003, 2008; Maor, & Fraser, 1996). In recent years, I also introduced Reading, Reflecting, Displaying and Doing model (R2D2), (Bonk & Zhang, 2008) to my students to capitalise on students’ differences and learning styles.

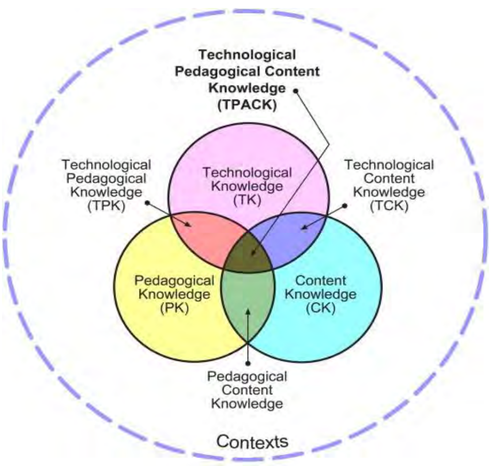

Figure 1. TPACK image http://tpack.org/

In many educational settings the discussion has already shifted from how to use technology to how students are learning. Researchers are focusing on the relevancy to the learners rather than on any particular tool that will be the key to learning. The increased use of technology in higher education creates a challenge of how best to utilise the technology for different purposes to maximize learning. There were great expectations that technology would change education, in particular that technology would enable greater accessibility and therefore increase the quality of teaching and learning in higher education. However, the argument exists that unless there is an emphasis on introducing the concept of *digital pedagogies* in teaching, there is not going to be a big change in education. *Digital pedagogies* refer to teaching–learning approaches in which digital technologies change the way we teach in order to promote learning. According to Kember (2008), digital pedagogies can refer to (but not only) personalized and authentic learning, learning in the global context and broader experiences and deeper learning. Yaniv (2008) suggests that the main initiative for the adoption of new technologies should be the need created by pedagogical concepts that could not be applied without technology. Developing digital pedagogies as a way of reframing pedagogies to better meet the needs of current and future students is an imperative in a digital world (Kember, 2008). Dron (2012) presents a different view. He suggests that the "widespread orthodoxy in the field of educational technology that pedagogies matter more than technologies and should come first when planning any sort of learning activity" (p. 23) needs to be challenged. Pedagogies are, in a very real and fundamental sense, themselves technologies insofar as they represent a set of techniques and tools for learning, and are as much technologies as the computers, forums, virtual classrooms and institutional structures in which they are used (p. 23). Therefore, Dron claims that there is no separation between digital pedagogies and technology. In other words, if our technological/pedagogical systems are to work, we need to understand the interdependencies between their parts (p.27).

With the increased use of Web2.0 and social media technologies for teaching, there is a necessity to frame our teaching in a more integrated and meaningful way. One such framework is TPACK which integrates teaching and technology in a critical way. Mishra and Koehler (2006) with their seminal work on the TPACK model enabled a new way of thinking about technology integration that emphasised the intersection of three domains of knowledge: technological, pedagogical and content knowledge (TPACK).

The literature suggests that there is a steady increase in the use of the TPACK framework, in particular in teacher education among pre-service teachers (Hechter, 2012; Yourdakul, Odabasi, Kilicer, Coklar, Birinci & Kurt, 2012). This together with accumulated research knowledge (Harris & Hofer, 2009; Dawson, 2007; Pierson, 2008; Harris 2008) helps us to think about technology integration with pedagogical content knowledge as an inspirational goal (Mishra & Koehler, 2006; Koehler & Mishra, 2009).

In teaching a unit that linked the theory and praxis of e-learning, I integrated two models: TPACK and R2D2 (Read, Reflect, Display and Do) (Bonk & Zhang, 2008) and underpinned it with the use of a social constructivist-oriented pedagogy (von Glaserfeld, 1989, Duffy, & Cunningham, 1996, Maor, 2003, 2008). I also used a blended learning approach with mobile technologies such as iPads, ePortfolio and other applications. The TPACK model facilitated my planning, implementation and assessment.

I wanted to develop digital pedagogies that would motivate and inspire students to learn. I also wanted to demonstrate these digital pedagogies that were aligned with the following learning attributes that students could adopt and carry into their own teaching:

- Interaction: Students engage in frequent, focused discussions with peers and the teacher.
- Peer learning: Students contribute reflective comments to peer conversations, on- and offline.
- Discussion leader: Students take a rotational leadership role as online facilitators.
- Facilitation: The teacher stimulates the discussion, presents core questions and topics, and challenges the students.
- Reflective practice: Students create reflective online journals in which they use technology to demonstrate their understanding and transformation of thinking over time.

To create digital pedagogies based on these constructivist learning principles, I had to make decisions about how to use the new technologies, what to use, when and for what purposes in relation to theories of learning and assessment (Lawless & Pellegrino, 2007). In addition, connectivity between people, according to Siemens (2006), changes the way people access, interact with, and process knowledge and therefore engagement with knowledge became more important than the knowledge itself. Thus the use of digital pedagogies moved the focus from technology and skills to a different way of working in a digital world.

Historical perspective of the development of TPACK

Shulman developed the initial concept of pedagogical content knowledge 27 years ago. His concern was that teachers view the need to teach subject matter separately from the way it needed to be taught. He combined these two domains of knowledge into pedagogical-content knowledge (PCK) (Shulman, 1986, 1987). Twenty years later, with the incremental increase in the use of technology in education, Mishra and Koehler (2006) expanded the model to integrate the third domain and created the technological-pedagogical-content knowledge (TPACK). This model provides a clear visual framework for practitioners to understand the knowledge required for effective integration of technology. TPACK is one form of highly practical knowledge that combines teachers' concurrent and interdependent curriculum content, general pedagogy and technological understanding (Harris & Hofer, 2009). Teacher education in many universities has utilised TPACK to evaluate programs and to pass on the knowledge of this framework to future teachers. The acronym 'TPACK' has captured the idea of a total package of elements (Borthwick, Charles, Pierson, Thompson, Park, Searson & Bull, 2008, p. 1) that can be used to assess the use of technology and its integration with pedagogy.

There are seven components that can be defined in the model. The next step in using the framework was to design an instrument to enable educational practitioners and researchers to examine teachers' perspectives on the different knowledge domains and the overlapping areas. A number of questionnaires were developed (Schmidt, Baran, Thompson, Koehler, Mishra & Shin, 2009; Archambault & Crippen, 2009) followed by a study on a USA sample of 596 K-12 online teachers using the designed questionnaire. The results suggest that "knowledge ratings are highest among the domains of pedagogy, content, and pedagogical content, indicating that responding online teachers felt very good about their knowledge related to these domains and were less confident when it comes to technology" (Archambault & Crippen, 2009, p. 71). The findings of this study also suggest a small correlation between technology and pedagogy domains, but a high correlation between content and pedagogical domains, emphasizing the need for further research and development in this area.

A different team of educational researchers (Schmidt, Baran, Thompson, Mishra, Koehler, & Shin, 2009) developed a checklist approach to examine the curriculum knowledge domains of pre-service teachers against the TPACK model. Harris, Grandgenett and Hoffer (nd) developed an assessment rubric through testing in K-12 education settings that can be used to review if a program had a "good" TPACK or how well the technology has been integrated in the areas of curriculum goals, instructional strategies, and the "fit" between all the knowledge domains. This process involved the development of the tool, feedback from TPACK experts and then the use of the tool by experienced teachers who used technology to assess the lesson plans of pre-service teachers. It was found that the instrument was reliable in assessing these planning documents (Harris et. al., nd).

In the Australian context, an education team developed the TPACK Confidence Survey (TCS) to look at the attitudes of teachers to the components of the TPACK (Albion, Proctor & Finger, 2010). In a longitudinal study of 35 beginning teachers, Bate (2010) examined how the teachers used information and communications technologies (ICTs) in the first three years of their teaching. Although they were able to clearly articulate their pedagogical beliefs that resonate with contemporary learning theory and operational ICT competence, they were unable to translate these pedagogical beliefs into practices that synergised pedagogical, content and technological knowledge (Bate & Maor, 2010). In 2012 a new design of the questionnaire not only attempted to analyse Vocational Educational and Training teachers' approach to integration of technology in TAFE colleges, but also conducted discriminant validity for TPACK construct (O'Brien, 2013).

The central issue of TPACK is related to the technology integration. However, to substantiate the research that examines the TPACK model, considerable theoretical work needs to take place to strengthen the field of educational technology. Graham (2011) argued that the research community that already engaged in research with TPACK had not done "the theoretical work required to make clear distinctions between model elements" (p. 1953). He critiqued the theoretical framework of TPACK and identified the following weaknesses in the model based on different research studies: lack of theoretical clarity, difficulties in establishing discrete and manageable categories that can be examined (Gess-Newsome, 2002), lack of specificity and lack of precise definitions (Angelie &Valanides, 2009), and unclear definitions of technology. For example, Cox (2008) found 89 different definitions for TPACK in the reviewed literature resulting in very few studies making a substantial contribution towards building a theoretical framework. Graham, also commented that "most instruments to date have not been able to establish an acceptable level of discriminant validity for TPACK construct" (2011, p. 1957). All these deficiencies require theoretical development for long-term viability of TPACK research.

Previously I have used TPACK as a general framework for the design and implementation of a master's level unit and to evaluate the unit. I analysed the activities implemented, the technologies used and the area of domain knowledge that the activities addressed (Maor & Roberts, 2011). The learning activities were addressing diversity and learning styles of the students based on Reading, Reflecting, Displaying and Doing, the R2D2 model (Bonk & Zhang, 2008). The Reading activities targeted the verbal and auditory learners, the Reflecting activities targeted the reflective and observational learners, the Displaying activities targeted the visual learners and the Doing activities targeted the "hands on learners".

Methodology

The participants in this study were 30 mostly postgraduate and a few undergraduate students (pre-service teachers, practicing teachers and school principals) enrolled in a degree in the School of Education in 2012. As the unit coordinator, I used a blended learning approach in an intensive, one-week, face-to-face classroom setting followed by three weeks of online group interactions. The content was e-learning, competency in the use of social learning tools and new technologies for teaching. A blended learning approach provides greater opportunities for diverse learning styles and stronger engagement. The R2D2 model within the context of TPACK was used to guide the selection of activities that emphasised interactivity, group work and collaboration. These attributes combined to characterise my *digital pedagogies*. The use of innovative pedagogies was examined by analysing students' responses in their ePortfolio, survey instruments and general feedback. I used TPACK as an analytical tool to examine students' reflections that provided feedback for further improvement. Through the students' work, I examined whether they understood the concept of digital pedagogies and how they were engaged with them. I wanted to know whether they appreciated the type of pedagogies I was trying to implement that included peer learning, interactive activities, the role of a discussion leader, and keeping a reflective journal. I facilitated the course in a way to make sure these attributes became embedded in the digital pedagogies.

I also reflected on my practice by using an action research design that incorporated qualitative methods and triangulation of different data sources, such as student artefacts, interviews with students, course feedback and the researcher journal. Students' reflections in their ePortfolio, their summaries of activities and online interactions created a rich data set for analysis and made the findings more credible. In this paper I review the way students reflected on the value of TPACK and R2D2 in the course and how they reacted to the implementation of my digital pedagogies.

Students' perceptions of the models/digital pedagogies introduced in the unit

In the following section, I illustrate examples of students' reflections about their engagement or disengagement with the elements that were introduced in the course from the 2012 intensive summer course cohort. Students had to take an active role in their learning during the week's face-to-face activities and during the one-month online interaction that followed. During this time, each group had to produce a project collaboratively. Students were assessed on: **creating an ePortfolio** using PebblePad to incorporate all the concepts, ideas and skills that they had learned in the unit using Web2.0 technologies, **a group presentation** on the use of the TPACK with a teaching scenario in a creative and authentic way, and **an online discussion** in which their contribution to others' learning to improve a teaching application was assessed.

Focus on pedagogy

The following excerpts illustrate that although the students perceived the value of the TPACK and R2D2 models as important frameworks for teaching, they also focused heavily on the pedagogy aspect of TPACK and other models:

> *We [our group] wanted our tool to be collaborative for the students, to utilise the R2D2 model explicitly, and to involve reflection by the students during the creation of their work. This meant that much of our focus was on the P[pedagogy] of TPACK, as we felt that the content could vary according to age groups, current projects and curriculum relevance, and that the technology itself was only one of many which could have been chosen to achieve the same learning goals.(StudentC, 2012)*

Several of the participants have begun disseminating the model in their workplaces. For example, a school principal when elaborating on the effectiveness of the unit suggested that all models that were used in the unit might contribute to pedagogical improvement:

The notions of constructivism and connectivism as well as models such as TPACK, R2D2 and the 4Rs have enabled me to critically reflect upon the ways in which I integrate technology into the classroom, how I lead my staff to do this better and how I can improve my pedagogy in this area. (*StudentA*, 2012)

The activities in the unit provided opportunities to promote pedagogies which were not related to the technology. For example, in a non-technology activity, a set of cartoons was presented to identify the teacher, learner and learning. Students negotiated the meaning in groups and through this activity they had to identify their beliefs about teaching and learning. The impact of this low-tech, team-based activity challenged the students' critical thinking skills:

The cartoon activity that we completed on the first day of the intensive week has stuck in my mind ever since. I found this extremely thought-provoking as it really allowed us to dig deep into our understandings of pedagogies as well as the teaching and learning process. (StudentD, 2012)

Focus on collaboration

Students collaboratively edited their presentations to a stage where they felt they was greatly improved and included more details related to their spoken parts. *"Particularly, we endeavored to elaborate on the use of TPACK and R2D2, which I feel we successfully achieved."* (StudentB, 2012). The collaboration was further enhanced when the group had to consult with each other and produce the final "project" after an additional four weeks of online interactions. This resulted in a high level of collaborative learning using Web2.0 technologies. Online communities sharing ideas and challenging beliefs can encourage deeper reflection. And according to a student, the biggest benefit of the online collaboration was definitely the student interaction:

We were able to work together and brainstorm ideas about topics, give feedback, ask and answer questions as well as share resources. I found that I was consistently reflecting on other students' questions/answers, as well as my own, even subconsciously. (StudentB, 2012)

Teamwork was improved dramatically. One student, who is the head of her department, wrote about how this unit transformed her teaching practice:

The teacher's approach has provided me with a pedagogical model for my own context as a teacher of mature-age students and my students have benefitted because of this. (Student letter, 2011)

Another student expressed greater awareness about her own process of learning and how she had to adapt her ideas when working with the group:

In my experience, the fourth R [4R model], reconstructing, was not truly meaningful until I became involved in the group presentation. In that role, the amount of responsibility is correlated with a certain level of self-reflection and existing knowledge. You have to be willing to adapt and to own your part in any experience, even when things don't turn out as you wished. (StudentM, 2012)

The use of technology also challenged students to be creative in presenting their assignments in different formats within the PebblePad portfolio:

This is the start of my Webfolio in the Pebblepad Format. I have attached a video as I want to extend and challenge myself with using technology and Web 2.0 resources to structure my reflections and my educational journey. (StudentG, 2012)

The feedback in student surveys suggests an innovative approach, through diverse activities and collaborative learning, caused students to be engaged:

The teacher provided a good learning environment that enhanced collaborative learning…and challenged each other's thoughts and ideas. (StudentE, 2012)

The teacher cleverly probed deeper with questions that made us think harder during class discussions. (StudentG, 2012)

Students' responses suggest a high level of collaborative learning using Web2.0 technologies. They also identified that it was important to have a teacher who could challenge them to think harder about issues.

Focus on use of digital pedagogies

The students had different responses to the strong attempts to implement digital pedagogies. One of the students, a practicing teacher, suggested that she is already implementing her concept of a digital pedagogy in her school:

> *Since hearing this on the first day, I feel I have done just that. I am thinking outside the square and looking at things in a new light and sharing my ideas with others. I have so far done two mini PD's at work to demonstrate these new skills I have obtained and working together we are exploring and finding other things we can incorporate/blend technologies. I am LOVING IT*! (StudentF, 2012)

As a final assessment task the students completed an ePortfolio in a PebblePad platform to demonstrate their learning throughout the unit. The ePortfolio requires integration of learning theories and the pedagogies being modeled. Students used digital artefacts and links to Web 2.0 resources to demonstrate their learning. The facilitator emphasised the high level of academic reflection she expected from students. Student feedback confirmed that this assessment task developed their knowledge in a practical way that they could apply in their further study and work as the following two examples illustrate:

> *This webfolio project has been a HUGE undertaking. This was a worthy undertaking and much of what I have learned will be transferred into my doctoral work*. (StudentE, 2012)

> *Using the TPACK and R2D2 Models (which I have already got on my office wall) will form a major part of my work with staff over the coming months and has also honed my own thought processes for using technologies with my students. I feel my learning has definitely strengthened in these areas and this will continue into the future*. (StudentA, 2012)

The facilitator constantly emphasized the value of digital pedagogies while demonstrating the use of the TPACK and R2D2 model. This consequently manifested in students' acknowledgment of the value of pedagogies. Two teachers wrote in their portfolio:

> *I feel that I have learned a lot from this unit and have an enhanced understanding of the pedagogies that underpin and provide a framework to integrate technologies best into the curriculum. Using some tools that I wouldn't have otherwise experienced has also been useful. Learning from others in the group through sharing and reflection of ideas, use of specific technologies, apps and tools was highly beneficial.* (StudentA, 2012)

> *Great idea to have to put our assessments items within ePortfolio. I would never have understood how a webfolio can actually work, if I hadn't had the exposure through this unit*. (Student, 2010)

Another two teachers understood the importance of the digital pedagogies as they expressed in their ePortfolio:

> *Well the R2D2 model, we have been working continuously within this model throughout our own learning of this unit. When I first started reading this book, I thought it had great ideas and was only thinking about it as a connection with the use of technology. I can see more clearly that isn't the case with this type of model. It offers the ability to enhance learning in any particular lesson; you just need to always question how to deliver this model [pedagogy].* (StudentJ, 2012)

> *I feel that the R2D2 and 4R models will (and have started to) transform my pedagogy as well as guide the conversations I have with my staff about meaningful integration of technologies into the curriculum. The R2D2 Model will particularly assist me in ensuring that students with different learning styles (diverse needs) have been catered for.* (StudentD, 2012)

For several people the activities and the use of digital pedagogies provided stimulus for further learning and research. Analysis of the reflection in the initial PebblePad Webfolio showed that studentN presented some intriguing questions that actually encouraged her to extend her postgraduate research into this area:

> *I want to do more research into TPACK. Are all things created equal in terms of the three parts? I also want to spend some time reflecting on the accuracy and worth of the R2D2 model. I might look into how*

> *these technology trends are affecting education in places like Africa, India and remote Australia. I want to look into peer assessment, having had a negative experience of it. I want to reflect on the potential negative side of all this technology - issues of screen time, entertaining the imagination right out of students, focus away from fundamentals (or are the fundamentals changing?), are community and relationships being rewritten*. (StudentN, 2012)

There were also critical points of view and criticisms from students. A pre-service teacher didn't appreciate the less structured approach for the online task and also questioned the frameworks presented in relation to the practicality and real world he is going to face:

> *I like the use of online collaboration as a reflective tool; I feel that it would benefit from more specific direction or discussion topics…. How does TPACK relate to the National Curriculum Drive, How can TPACK assist in understanding MySchool?* (StudentF, 2012).

One group of students in this unit felt like they were in a marathon. According to this group, the unit was intense, demanding and exhausting. They also thought the level of work demanded was very high. Other pre-service teachers were not impressed with the very intense nature of the course and with challenges for reflection and interaction with their peers that were presented. This, in some cases, created obstacles for understanding, thus, a few students did not engage with the digital pedagogies and did not collaborate with the other students. They were less committed to the interactive spirit of the class. How could a teacher get these students more engaged with digital pedagogies? Would relating the unit to some of the practical questions raised by Student F above, such as to the *National Curriculum* and to *MySchool* be one possible direction to take?

Overview of student perceptions

Overall the students found the unit to be very challenging. As they became more engaged in the unit, they could see the value for their own classroom practice and in particular the TPACK model. Some were motivated to turn the questions that arose during their learning experience into postgraduate research studies. Other commented on how they could use these pedagogical models to improve their classroom practice or enhance teachers' views on pedagogies. There were the few who remained on the periphery of the unit and did not engage with the interactive mode of the class. The diverse perceptions have a common core of new understanding of the integration of technology and pedagogy with the purpose of improving and creating new opportunities for learning.

Conclusion

Although this paper may read like a success story in the fact that the majority of students adopted digital pedagogies and implemented them in their classrooms, it also raised the question: Does this analysis help us to better understand the difficulties in implementing a complex e-learning environment that attempts to promote digital pedagogies? It became clear that there were difficulties for some students to engage with this type of environment. Thus, it means that further discussion is necessary to understand the nature of this concept and how to implement it successfully.

The concept of *digital pedagogies* describes the essence of teaching/facilitation in this unit. The unit was designed using digital resources and a sound pedagogy that engaged the learners in a technology-rich environment. It ensured curriculum relevance and used strategies that encouraged a collaborative educational experience, taking account of differences in learning styles. The excerpts from students demonstrated the spirit of the digital pedagogies that was facilitated through collaboration and peer learning. They also illustrated how the combined used of the TPACK and R2D2 models strengthened the concept of an integration of the different knowledge domains of pedagogy, technology and content. However, these models only provided us with a framework for teaching. They did not provide us with the interpretation, flexibility and creativity that required from a good teacher or from a "digital pedagogue" (Yaniv & Crichton, 2008). The collaborative nature of work that was created in this unit did not happen in a vacuum. It was created through the digital pedagogies that the facilitator built up and engaged students with during a challenging period of teaching. Therefore, currently we have learnt to address the new learning requirements of the 21st century in better way. We had the example of the principal that engaged his staff with the TPACK framework in a meaningful way, a primary school teacher who initiated a PD for colleagues and introduced innovative technologies and we have a postgraduate student who asks critical question in relation to research in this area and analysed it in her doctoral studies. But have we reached an optimal solution?

So, what opportunities and challenges await us? The concept of *digital pedagogies* will need further clarification in future research that focuses on the mindset and skills required for effective teaching and learning in our *digital* world with the rapid increase in the pace of technological innovation. This should also lead to a new form of professional development to promote a better understanding of the synergy between technology and pedagogy. Teachers will become "digital pedagogues" and have the ability to develop pedagogies that continue to evolve according to the needs of the students in a digital world.

By examining students' reflections, they became participants in the scholarship of my own teaching practice. Students' excerpts suggested a strong emphasis on communication and collaboration, which helped to create a community of practice. This was complemented by TPACK in the design and implementation of the unit with its strong emphasis on the integration of different knowledge domains. The synergy between pedagogy, technology and content area creates opportunities for digital pedagogies.

Learning from the past about the integration of technology, pedagogy and content knowledge can provide a good understanding of how to integrate technology into teaching while using constructivist pedagogies to utilize the technologies in appropriate ways to alleviate difficulties in teaching or learning content and concepts. This present understanding of the use of TPACK also paves the way for educators to engage students in collaborative learning and to develop the concept of *digital pedagogies*. Digital pedagogies may be the concept that can encompass all: teaching approach, students' attitudes and desired learning outcomes. However, further research will be needed to establish that this is a good direction for the future.

So what comes next? The next stage is to refine the concept of digital pedagogies so that research can be implemented to see if its attributes enhance more critical and reflective learning. New models and more critical thinking about digital pedagogies are emerging all the time. For example a new model, such as the SMAR (Substitution, Augmentation, Modification and Substitution), might contribute to the discussion of improving 21st century learning. However, at this stage, we don't fully understand the present so how can we imagine the future?

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MOOCs - what's cultural inclusion got to do with it?

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This paper outlines a preliminary scoping exercise that surveyed how good practice principles around cultural inclusion are currently incorporated into online learning, and more specifically, into Massive Open Online Courses, or MOOCs. Combining good practices principles for learning and teaching across cultures and elements of Universal Instructional Design, this small-scale survey of courses provided on four MOOC platforms - Coursera, Udacity, Open2Study and edX - looks at determining what can be considered good culturally inclusive practice. The aim of the project is to establish minimum standards and examples of good practice that can form the benchmarks for all online units.

Keywords: cultural inclusion, MOOCs, online teaching.

Introduction

How does cultural inclusion work in online teaching? This question, asked in a 2013 workshop on "Teaching for cultural inclusion", is the starting point for this study, which explores: a) what is good practice for teaching for cultural inclusion online? and b) how is this enacted in specific online learning environments? The rapid emergence of Massive Open Online Courses (MOOCs) and the intense discussion around their present and future impact on higher education has provided additional impetus. MOOCs are fully online learning and teaching spaces involving thousands of learners from around the world (Daniel, 2012), and thus present an ideal medium for an enquiry into how good practice for teaching for cultural inclusion might be applied online. This paper presents results from a preliminary scoping survey that surveyed how cultural inclusion, as expressed through the good practice principles of Universal Instructional Design (UiD), is incorporated into four MOOC learning environments, with the long-term aim of providing recommendations for a culturally inclusive MOOC using UiD.

The point of difference in our survey is the use of a definition of culture and cultural inclusion that is very broad, beyond nationality and ethnicity to also include 'cultural' attributes such as gender, ability, language, age, lifestyle, and other 'sub'-cultural differences (Goold et al. 2007). With regard to online learning and teaching then, such a definition aligns as much with the principles of universally accessible design, as with traditional conceptions of culture and cultural inclusion in learning and teaching (Herskovits,1955; Goodenough,1981). Hence our focus in this paper is on UiD as an alternative approach for developing good practice for teaching for cultural inclusion online. Here we focus on the first three UiD principles - *equitable use*, *flexible use*, and *simple and intuitive use* - as these most closely align with our broad definition of culture and cultural inclusion. In turn, these UiD principles have been translated into criteria for culturally inclusive learning and teaching online. Two units from four MOOC providers were then assessed against these criteria and the results presented here, with some broad recommendations for future work in this area using this approach.

Literature review

Developments in technology have provided access to online learning material to a greater number of people. Massive Open Online Courses (MOOCs) have been a central topic of discussion over the past year (Daniel, 2012), specifically with regards to their impact on Higher Education. MOOCs are units aimed at large-scale participation, where participants are dispersed, and access to these courses is open via the web (Daniel, 2012). According to Singh et al. (2005, p. 22) such a "diversity of the new student population requires that institutions carefully develop programmes that will satisfy a broad range of learning requirements". Our argument here is that the issues go beyond catering to diverse learning requirements and should also expand to creating online spaces that cater for culturally diverse learners.

Universal design, defined as "the design of products and environments to be used by all people, to the greatest extent possible, without the need for adaptation or specialized design" (Mace, 1997) arguably supports a culturally diverse cohort. Various researchers have provided examples and applications of the UiD principles (Dukes et al. 2009; McGuire, 2011; Eberle et al., 2006; Frey et al., 2010) in relation to education. Universal Design incorporates nine design principles (Mace, 1997); here, we examine the first three: *equitable use*, *flexible use*, and *simple and intuitive use*. *Equitable Use* follows an "anyone, anytime, anywhere" rule where content is expected to be available and accessible to every course participant, without excluding or stigmatising any individual. *Flexible Use* is aimed at accommodating different learner styles and requirements. *Simple and Intuitive Use* aims at providing a learning environment that does not discourage learning through complex and technically challenging constructs. While the basic UiD principles are the same, the literature varies in terms of specifying what each principle means for actual practice. Table 1 identifies how some educational researchers have interpreted the UiD principles.

Table 1: Amalgamation and application of UiD principles in an online learning environment

Universal Instructional Design	Dukes et al. (2009)	McGuire (2011)	Eberle et al. (2006)	Frey et al. (2010)
Equitable use				
1) Courses material readily available	X	X	X	
2) Course content in multimodal form	X		X	
3) Electronic versions of syllabi, rubric, handouts, scripts, etc.available	X			
4) Student assignments are submitted and returned electronically	X			
5) Privacy is respected			X	
6) Students with disabilities are neither segregated not stigmatised.			X	
7) Statement for accommodating students with disabilities is provided			X	
8) Information for self-help available			X	
9) Idioms, local expressions, pop culture, metaphorical language avoided or explained			X	
10) Culturally specific symbols avoided or explained			X	
11) Too much text is avoided, graphics and visualisation used where possible			X	
12) Stereotyping gender roles, religious groups, cultures, etc. avoided			X	
13) Horizontal text used only				X
Flexible use				
14) Various opportunities for participation and engagement	X			
15) Students can demonstrate knowledge through multiple means			X	
16) Material is presented in different formats, i.e. html and pdf.			X	
17) No time limits / offline access				X
Simple and Intuitive use				
18) Students should be able to operate every course function using a similar process	X			
19) Grading rubric that clearly lays out expectations for assessment		X		
20) Practice of sample items are provided				X

21) Specific terms or difficult words are linked to definitions			X	

Method and Results

Each researcher compared two courses across four MOOC providers (*Coursera*, *Open2Study*, *edX* and *Udacity)*, in terms of how each course incorporated cultural inclusion, using the UiD principles as the framework. Following on from previous studies the researchers 'translated' the principles into specific criteria that might indicate a cultural inclusive online learning space (Table 2). To eliminate bias, the criteria for good practice were discussed and established by the researchers beforehand. Each researcher then surveyed two MOOC providers according to these criteria, and then reviewed all results as a group.

Discussion

Overall, the eight MOOC units surveyed measured up well against the UiD Principles in facilitating and encouraging cultural inclusion in their specific learning spaces. While content in all eight courses was mainly

Table 2: UiD principles with cultural inclusive criteria as evidenced in selected MOOC courses

Universal Instructional Design (examples)	edX	edX	COU	COU	O2S	O2S	UDA	UDA
Equitable use								
1) Courses material readily available	X	X	X	X	X	X	X	X
2) Course content in multimodal form	X	X	X	X			(X)	(X)
3) Electronic versions of syllabi, rubric, handouts, scripts, etc. available	X	X	X	X	(X)	(X)	(X)	(X)
4) Student assignments are submitted and returned electronically	X	X	X	X	X	X	X	X
5) Privacy is respected	X	X	X	X				
6) Students with disabilities are neither segregated not stigmatised.	X	X	X	X				
7) Statement for accommodating students with disabilities is provided								
8) Information for self-help available	X	X	X	X	(X)	(X)	X	X
9) Idioms, local expressions, pop culture, metaphorical language avoided or explained			X	X	X	X	X	X
10) Culturally specific symbols avoided or explained	X	X	X	X	X	X	X	X
11) Too much text is avoided, graphics and visualisation used where possible	X	X	X	X	X	X	X	X
12) Stereotyping gender roles, religious groups, cultures, etc. avoided	X	X	(X)	(X)	X	X	X	X
13) Horizontal text used only	X	X	X	X	X	X	X	X
Flexible use								
14) Various opportunities for participation and engagement			X	X		X	X	X
15) Students can demonstrate knowledge through multiple means			X	X				
16) Material is presented in different formats, i.e. html and pdf.	X	X	X	X			(X)	(X)
17) No time limits / offline access			(X)	(X)	X	X	X	X
Simple and Intuitive Use								
18) Students should be able to operate every course function using a similar process	X	X	X	X	X	X	X	X
19) Grading rubric that clearly lays out expectations for assessment								
20) Practice of sample items are provided	X	X	X	X	X	X	X	X
21) Specific terms or difficult words are linked to definitions								

COU –Coursera, O2S –Open2Study, UDA –Udacity. X means fulfillment, (X) means partial fulfillment provided through videos, all included the option to read and download transcripts for all lectures. All PDFs and pages that were tested were also found to be accessible.

Coursera units did relatively well with regards to structuring and presenting learning material for a culturally diverse student cohort. Units are presented in short 7-15 min videos, which provide download options of the video script, subtitles and MP3 files to enable offline learning. Videos usually display embedded bullet points or key terms that summarise or highlight the significant parts of the lecture which makes for easier understanding for non-native speakers and learners who are not familiar with the (English language) terminology of the discipline. Assessment takes place via surveys, quizzes, exercises, and discussion forums, written and spoken assignments. The course outline is easy to navigate and it provides alternatives to different learner types. Inclusivity and community are strongly encouraged and well facilitated in various discussion forums. The facilitators respond to students' inquiries and actively participate in online discussions. The unit communication is void of culturally specific terms to include the students around the world.

Learning in the Australian-based *Open2Study* platform rotates around videos. Assessments are not mentioned during the videos, but after each video there is a one-question 'pop quiz'. The system is easy to use, however, having only one option for assessment - multiple choice - is limiting as it does not provide options to show that the objectives of the unit are met. Since this is the only type of assessment there are no rubrics, and learning outcomes are only briefly mentioned in the first video. Aside from the videos, there is very little other learning material, and the videos are not simple to download for offline viewing.

Udacity is helpful in providing a summary of the class: what you need to know before taking the class and what you will learn. It also provides the unit's syllabus separate to the videos. Participants from diverse cultural backgrounds may find it useful as it structures the learning content and material and also prepares the learner for what is to come by providing clear expectations. However, once in the videos, some icons are mislabeled and may be misleading: for example, the *wiki* icon does not take you to a wiki but to class notes and other materials. This makes finding key information difficult. Information on assessment is also not available nor are grading rubrics. This may raise questions for students, especially those who are not familiar with cultural norms and/or university requirements. Assessments use multiple choice or short answer format. The wiki content is not searchable, but the discussion forum is, in contrast to Open2Study platform, which does not allow for content searching. In this platform videos can be downloaded from the wiki page.

The *edX* platform provides a clean and simple interface for its individual courses, based on videos and 'interactive transcripts' where the user clicks on a section of the transcript and the video jumps to that point. This is very useful for fast-tracking and slowing down the progress of video instruction, which may be useful for non-native English speakers. The courses surveyed generally used simple language, avoided idioms and culturally specific symbols, and all courses included material that was accessible at any time and through a variety of modes. Online learning communities were encouraged through forums and wikis, however, these were course- and discipline –specific.

Conclusion

This scoping study reviewed eight units in four MOOC platforms against three principles and 21 associated criteria of UiD, to show how this approach might be used to reveal how cultural inclusion is incorporated in online learning and teaching environments. The findings have implications for both research and practice. This paper has indicated clear links between this approach and other more 'traditional' methods for identifying cultural inclusion in online learning and teaching. *Respect and adjustment for diversity*; *providing context-specific information and support*; *the facilitation of meaningful intercultural dialogue and engagement*; *adaptability and flexibility* (OLT, 2013) as good practice principles according to a current national project for teaching and learning across cultures (OLT, 2013) have been shown to be central to UiD. At the same time, there are some issues, including a lack of consensus around what each principle means in practice, as well as some overlap in the UiD principles – for example, the criterion *Various opportunities for participation and engagement* can be included under both *Flexible Use* and *Equitable Use* as it encourages participation of all students and allows participation in different ways. Another limitation is presented by UiD criteria that refer to culturally-specific concepts such as privacy, which differs across cultures. Future work involves further unpacking of the UiD principles and criteria and testing them against other MOOCs and online units from various institutions.

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Using the e-learning Maturity Model to Identify Good Practice in E-Learning

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E-learning is a complex endeavor which presents significant challenges as the scale and complexity of different technologies and pedagogical models grows. The e-learning Maturity Model is a quality framework aimed at helping educational institutions engage with this complexity both by understanding the state of their current organizational e-learning capability, but also by providing tools aimed at systematically improving that capability. The eMM framework includes an extensive body of information drawn from the literature but is also intended to help identify useful examples from different institutions so these can inform other organization seeking ideas for their own situation. This paper describes a number of such examples of good practice identified as part of an ongoing project applying the eMM to Australian universities, and signals the potential outcomes possible from a more complete sample in the future.

Keywords: e-learning maturity model, eMM, quality

Introduction

Recent interest in large-scale e-learning sparked by the Massive Open Online Course (MOOC) model being adopted by a number of prominent international universities (Cormier, 2012; Daniel, 2012) has highlighted the complex nature of the strategic and educational choices facing all universities. In part the challenge arises from the competing nature of the forces shaping higher education, which can be imagined as a series of scales or axes in a multidimensional space. These forces act on the organization, applying stresses that can sustain collective action or weaken it. A possible set for higher education could include (Sporn, 1999; Shattock, 2003):

- Demographic and political changes driving the scale of higher education, including increasing globalization in all forms of commerce, specifically in this case education;
- Financial challenges and constraints both in terms of access to resources but also the diversity of the sources of revenue; for organizations and also for individuals;
- The importance of qualifications and the role that they play in shaping the nature of the university;
- Internal and external stakeholder influences. Many, varied and often in conflict with each other;
- Technological innovation/integration. The challenge of understanding the contribution that new technologies can make and realizing those opportunities in a complex organization;
- The Open agenda (Wiley & Nelson, 1998; Stallman, 2002), with changing models of information use and ownership reflecting the low cost of duplicating digital goods and a reaction against commercial intellectual property and ownership behaviors.

In the face of these challenges, the maintenance of an effective technology infrastructure remains a key strategic focus for university leaders, but it is less clear that they are seeing a positive response from many academics (Allen & Seaman, 2013; McCarthy & Samors, 2009). Some years ago, Taylor (2001) observed that the challenge facing universities innovating with technology is the execution of the change. The qualities of organizational engagement with technology discriminate between organizations reacting to their environment and those that are leading and shaping it (Carr, 2003; Hamel & Välikangas, 2003; Hagel, Brown & Davison, 2008).

Quality in higher education is, however, a complex area with a highly politicized mix of approaches and measures used to assess different aspects of institutional work. Many of the quality measures used in commercial contexts have proved problematic when applied to higher education (Koch, 2003; Quinn, Lemay, Larsen & Johnson, 2009) and quality is more often than not defined by assurance and accreditation activities, which have questionable value (Chalmers 2007; Gibbs 2010; Hénard 2010; Law, 2010).

The e-learning Maturity Model (eMM, Marshall, 2006a; 2006b) is a quality improvement framework designed to support educational institutions interested in improving their organizational capability to use technology in learning and teaching in a complex and changing environment. The measurement framework included in the eMM can be used for benchmarking purposes but the intention for doing so is not to rank institutions or identify 'winners' or 'losers' but rather to support collaboration by institutions. This collaboration takes two main forms, it can be through joint benchmarking projects using the eMM to identify common areas needing improvement, and it can be through institutions sharing examples of their e-learning activities that can help other institutions explore different alternative systems and processes with the goal of improving the experience of staff and students and supporting the achievement of the wider organizational goals and objectives. This idea of collaboration underlies a pilot study expanding on an earlier project (Marshall, 2009), which is progressively applying the eMM to a sample of Australian universities (ideally ultimately a census rather than just a sample).

The culture of political and financial accountability and quality assurance has had the consequence of making institutional leaders cautious in their use of such information, and even reluctant to be identified more than as required by sector agencies. Tools such as the eMM provide an opportunity for exploring ideas of quality with a focus on improvement, and an opportunity to move away from at least some aspects of the 'league table' mentality. The eMM summaries of organisational capability are just that, summaries. The use of colour and the matrix of results (such as in Figure 1 below) resist attempts to create simplistic, ranked, lists and instead encourage a recognition of the rich complexity that influences the quality of e-learning in large institutions. Behind the visualization there is a rich data set of educational and organizational activities that embody specific aspects of quality and which can provide models for guiding improvement in other institutions. Unlike the summaries, these examples of good practice cannot be used for performance measurements and accountability by external agencies and so we can (with their permission) provide details of these good practices in their full institutional context.

This paper describes progress to date in the project, identifying good practices and challenges that are already evident, and signals the potential outcomes possible from a more complete sample in the future.

Methodology

The project commenced with a eMM assessment of each participating institution. The eMM capability assessments were done with the eMM version 2.3 practices and processes outlined in Marshall (2006b). A brief summary of the assessment process is provided here, more extensive detail of the application of the eMM is available in the literature (Marshall, 2006a, 2006b, 2009, 2010, 2012a). The eMM assessments conducted to date provide each individual institution with detailed information on their e-learning capability. They also provide the opportunity to identify examples of good practice as well as opportunities for improvement that are common to all institutions.

In undertaking this analysis a few caveats should be noted. Firstly, the ethics approval conditions applying to this research mean that which assessment relates to which institution must be kept confidential. The institutions identified in this paper have consented to being identified as participants, but care has been taken to ensure that it is not possible to associate a given assessment with a specific institution. The good practice examples given below should not be seen as directly indicating capability in the eMM as they constitute only part of the evidence used to make assessments. A common experience when conducting eMM assessments is to see examples of good practice in specific units, but to not see that recognized and adopted more widely in the institution. Finally, the sample of universities assessed cannot be described as fully representative of the diversity and range of practice internationally. Consequently, the examples given below may be good practice but cannot be described as best practice (whether or not 'best practice' can ever be meaningfully identified is another question entirely). The eMM project aspires to collect a more complete sample of Australian universities but this is dependent on institutional willingness to participate and the time needed to complete the assessments.

Ethics approval to undertake this research was obtained from the Victoria University of Wellington Human Ethics Committee (Approvals #19035/2011, #17271/2010 and #73/2004) and also from each participating institution.

Results

Overview of the eMM assessments

A total of eight Australian university assessments have been completed over the last year. The assessments are summarized in Figure 1, with the results from the eight new assessments compared to a selection of other international universities provided as reference points (Marshall, 2012a; 2012b).

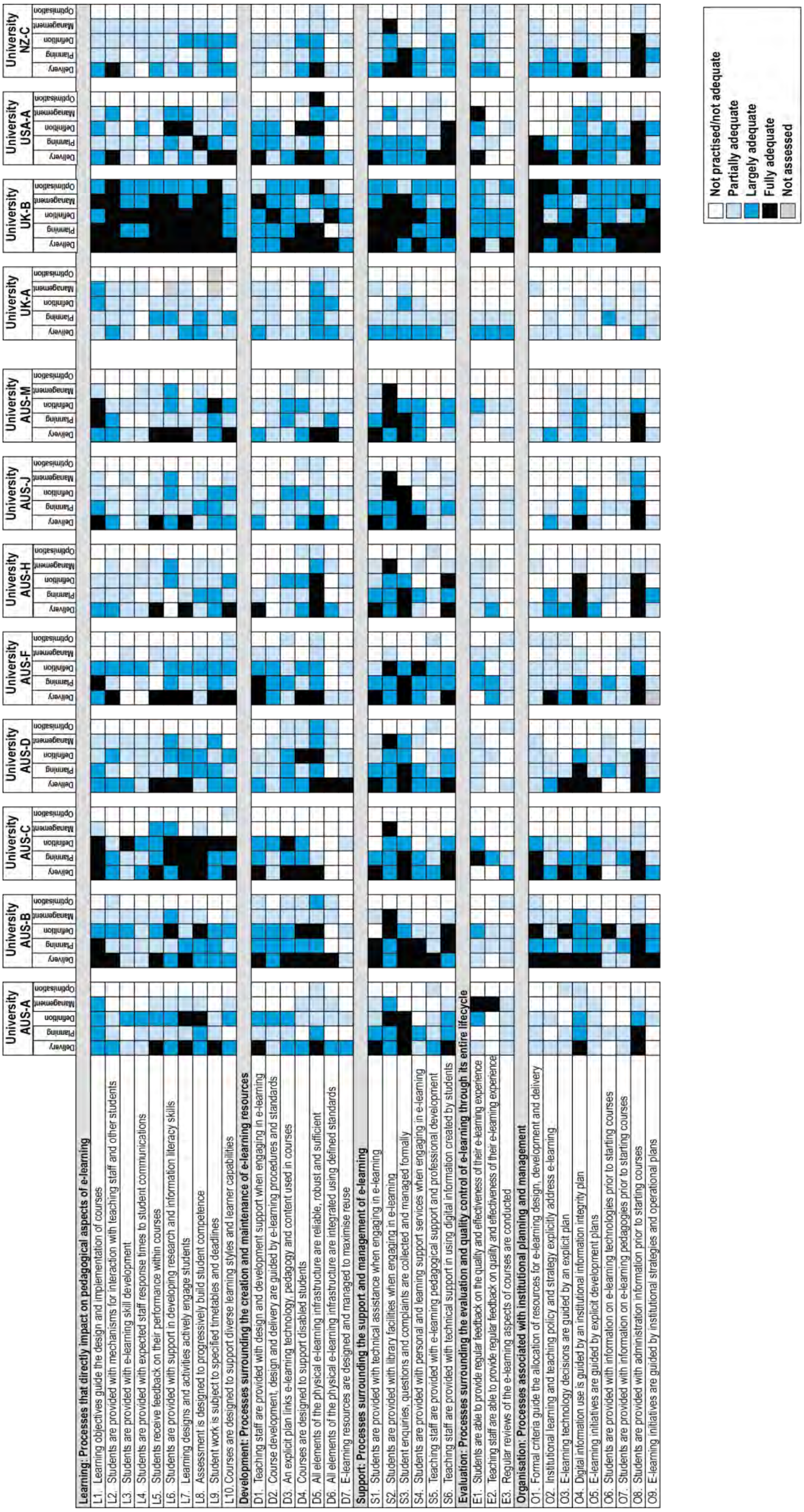

Figure 1: Australian university eMM assessments (sample of other universities provided as context)

Looking at the results in Figure 1, some general observations can be made. The capabilities assessed for the Australian universities generally sit in the mid-range with no university as weak as University UK-A but none as capable as UK-B (a specialist distance provider widely regarded as among the best in the world at online education). Universities AUS-B and AUS-C demonstrate the strongest overall capability, with strong (dark) assessments for the Delivery, Planning and Definition dimensions of most processes. However, even these institutions share weaknesses with most of the other institutions. All of the institutions assessed are weak in the Management dimension and also in the Evaluation process area. This reflects the somewhat surprising lack of systems analyzing the impact of technology on student learning and staff teaching activities. This lack is surprising as there is a strong focus on performance reporting and management systems apparent in the Australian institutions but these are not directed at improving the outcomes measured by the eMM.

Other shared weaknesses include process D7 “E-learning resources are designed and managed to maximise reuse” where most universities were found to have minimal engagement with reuse, process L3 “Students are provided with e-learning skill development” characterized by a focus on technical support rather than pedagogical; and processes O6 and O7, reflecting the lack of information for students helping them prepare for the use of technology in their studies.

These weaknesses are not limited to the Australian universities whose assessments are reported here (Marshall, 2011). They appear to reflect common challenges faced by many educational institutions, not just universities (Neal & Marshall, 2008; Sero, 2007). One of the goals of the eMM is to identify possible ideas for addressing these and other weaknesses, exemplars of organizational activities that can be used to guide improvements more widely. The summary assessments in Figure 1 represent the overview of judgments made against nearly 900 practice statements referencing a substantial evidence base of individual courses, institutional documentation and interviews. While this visualization helps institutions focus onto priority areas for improvement, this overview also obscures the outliers that demonstrate plausible and successful ways of improving aspects of e-learning, many of which are so specific or operational in scope as to never warrant substantial investigation and empirical analysis by scholars. In the next section a number of such exemplars identified in the current project are explored in the hope that these will stimulate wider uptake of such ideas even in the absence of substantive evidence bases justifying each small improvement.

Seeking examples of good practice

This section presents several examples of good practice highlighted during this project. In describing these as ‘good’ it should be clear that this judgment is on the basis of the practices identified in the eMM rather than as a result of an exhaustive and empirical measurement of excellence. These should be seen as ideas to stimulate engagement and improvement, heuristics rather than standards. An ongoing problem in the field is demonstrating that capability measured by a variety of tools, including the eMM, reflects a real and consequential aspect of an organization’s ability to be successful. It may only be possible ever to demonstrate that the process of engagement with quality improvement tools is in itself helpful to those attempting to stimulate and sustain positive organizational change.

Learning objective *What you should be able to do*	**Learning opportunities** *What you can do to achieve the objective*	**Assessment** *How it is assessed*
1 Critically assess current and historical claims about language curriculum development in context and indicate types of evidence to support the claims.	• Read relevant published material and course notes about formulating research questions. • Read relevant published material and course notes on trends in language teaching. • Become practised at identifying claims in paragraphs from articles and establish whether they are empirical or evaluative in nature. • Relate your own experience to various trends in language teaching. • Explore ways of establishing evidence for the claims. • Clarify information by: making verbal or diagrammatic summaries, raising questions in class or on Blackboard • Seek feedback from peers and tutors on your understanding.	This is a general objective and will be assessed in Tasks 1 and 2
2 Justify a set of learning goals and linked learning opportunities for specific learners.	• Read relevant published material and course notes about needs analysis, motivation, and goal theory. • Practise describing the learning needs of individual learners and how goals might capture these needs. • Practise analysis of goals including their specificity, relevance and measurement.	Task 2

Figure 2: Example of a student oriented learning objective mapping

All of the universities assessed by the eMM make use of learning objectives, with all providing some form of standardized statement listing objectives in the unit documents supplied to students, and this is clearly apparent in the capability assessed for process L1 “Learning objectives guide the design and implementation of courses” in Figure 1. Australian universities in particular have clearly adopted constructive alignment as a general approach to individual unit and course design. In some cases this has resulted in extremely elaborate mapping tables which, while useful to staff orienting themselves to teaching or revising a unit or course, are of more questionable value to students. These statements of learning objectives are commonly mapped against the assessment programme of a unit, however in all but a few cases the value of these mappings are unclear. Many examples of units mapping all objectives to all activities were observed, far less common were examples of units conveying the information in a manner that enabled a pro-active response by students (e.g. Figure 2).

At Queensland University of Technology (QUT) the Unit Outlines are available to students prior to enrolment and in addition to the standard sections listing learning objectives and assessment, they have a section titled Approaches to Learning and Teaching that explains the design of the course and the way that various activities will contribute to student learning:

Approaches to Teaching and Learning
Classes are 3 hours each week. The 3 hour class will be used for a lecture which introduces new material, and a workshop on the previous week's work. For all lectures a lecture outline is available on the [course] Blackboard site and should be downloaded prior to the lecture. You will get the most out of the lectures if you bring the Lecture Outline with you. Homework questions are included in each lecture outline. Students are strongly encouraged to keep up with the work by completing all of these questions in the allotted week.

This unit will encourage you to conceptually link the theoretical aspects with the practical aspects and thus you will be able to apply your knowledge to a wide variety of [subject] situations. Lectures will provide an introduction to the theoretical concepts, and will use practical examples to illustrate techniques and processes. Your learning will be supported by more in-depth homework questions which are designed to further develop your understanding of the material covered. Solutions for all homework questions will be provided on the [course] Blackboard site each week. Full lecture notes will be provided on the [course] Blackboard site at the end of each week.

Homework Questions: The basic understanding provided in lectures will be developed through the use of practice questions. To achieve the objectives of the unit it is essential that you complete the practice questions each week so that you can develop a sound understanding of the content of the unit.

Workshop Questions: The workshop questions are designed to further reinforce the work covered in the lecture, to show how various issues in the lecture material fit together, and to give students the opportunity to see how problems are worked, and discuss why something is done a certain way.

This information makes no presumption about the experience of the student and helps them understand how the different parts of the course are designed to work together in the student’s interest. Technology used in the course is also clearly apparent, if sometimes somewhat passively integrated. Courses which take advantage of other tools and facilities such as discussion fora, virtual classrooms, wikis, etc. can use this section to highlight these to students. QUT also has a clear focus on the role that formative feedback plays in student learning with all unit outlines including a section on assessment that covers the feedback student can expect:

Assessment
You will receive multiple sources of feedback, including:
• immediate feedback on basic knowledge and application via computer generated responses to selected quiz questions;
• self-reflection on learnings from quizzes;
• ongoing oral feedback from peers as well as teachers on problem-solving;
• written feedback on problem solving tasks and strategies to assist and improve your learning; and
• broader feedback from teachers, peers and industry representatives.

This type of information helps reinforce the idea that students are expected to learn actively, to take the opportunities and experiences of a course and use these to learn, rather than passively accept a body of knowledge. An institution implementing systems equivalent to these three examples will be well positioned to communicate new pedagogies to students and will plausibly help students from a variety of backgrounds engage effectively with the courses. As tertiary education continues to expand to meet the needs of students with an increasingly diverse range of backgrounds and levels of preparedness such systems will become essential.

Throughout the assessments of the Australian institutions it is apparent that scaling the support of staff using technology in their teaching is a significant challenge, particularly with regard to the pedagogical aspects. All of the universities were assessed strongly in the Delivery dimension of process D1 "Teaching staff are provided with design and development support when engaging in e-learning" reflecting the provision of technical support and development resources. However fewer were assessed strongly in process S5 "Teaching staff are provided with pedagogical support and professional development in using e-learning", with the majority of the available support being framed around the use of standard LMS facilities without any redesign of the course activities and assessment to take advantage of e-learning technologies. Those institutions which have developed strategies and plans for wider adoption of technology in their courses invariably acknowledge that full service support models for academics cannot scale, due to the cost, but also because of the lack of available skilled support staff and the inflexibility such as large-scale service would create.

A much more attractive support model identified in several eMM assessments is that of enabling academic staff to work collaboratively within their school, department or programme to engage in e-learning (re)design and development projects. Under such a model, support activities become more about facilitation and advice than hands-on involvement. Despite the recognition of the value of this model, however, few institutions had created resources that facilitated independent action by their academic staff.

One exception was Griffith University, who in addition to a wide variety of other support materials and assistance from pedagogical and technical staff, have also produced a useful handbook "Getting Started With Blended Learning" (Bath & Bourke, 2010). This document is designed to assist staff working through a complete e-learning project. It starts with a clear discussion of the idea of blended learning and the associated terms that often confuse academics new to the area, as well as a clear description of the support provided by the institution. The bulk of the document guides academics through a clear project process (planning, designing, developing, implementing, reviewing and improving), with a strong emphasis on the need to have clear learning goals aligned at both programme and course levels. A series of detailed questions are asked stimulating the academics to consider the relationship of the course being changed with wider programme and institutional goals, the characteristics and needs of their students, and the specific goals of the course and academic staff.

Moving onto technologies, the Griffith handbook focuses on the pedagogical aspects rather than the technical. Examples are provided of the ways specific technologies support particular student learning outcomes and a number of major technology types (such as wikis, lecture capture, and virtual classrooms) are described in sections with information helping academics understand the opportunities but also the challenges or limitations of each technology. Each technology section is filled with advice and also links to more detailed resources. The focus is very much on understanding the pedagogical and practical affordances of the technology, helping the academic to choose which options will best suit their particular circumstance. Similarly, the La Trobe University Flexible and Online Learning Development (FOLD) Exemplars (http://www.latrobe.edu.au/teaching/flexible-and-online-learning/exemplars) illustrate how universities can provide staff with guidance based on the experience of their colleagues with a detailed educational context, rather than technically oriented service catalogues that simply enumerate products. These case studies are invaluable but experience of such initiatives over several years suggests that they are hard to maintain unless some mechanism associated with e-learning support and development is actively soliciting and updating the resources. There is also the issue that many case studies of this type are light on empirical evidence of impact, limited their ability to promote organizational changes in e-learning.

Change is a challenging aspect of e-learning. New technologies present particular challenges to the IT groups charged with ensuring that the IT infrastructure is sufficient, reliable and robust, while also able to be responsive and supportive of educational innovation. RMIT's "Business and ICT Maxims" (Schalken, 2012) demonstrate one useful approach to this challenge. The Maxims "are statements of preferred direction or practice. They reflect a level of consensus among the various organizations within an enterprise, such as business units, ICT, and support groups" (Schalken, 2012, p. 4). By stating the principles that guide IT decision making clearly, they help non-specialists understand the issues that underlie existing and new policies. Consequently, staff intending to engage with new technologies are able to understand the wider concerns that frame their ability to deploy systems and tools within the organizational context.

Also helpful is the use of documents that outline the future plans of the university for the deployment, maintenance, and ultimately retirement of technologies. Realistically, few universities have the resources to purchase every available product and integrate it into the existing infrastructure. Often the process of selection and deployment can take months or years, and a 'roadmap' with an integrated lifecycle provides a useful means of communicating the university's intentions. Figure 3 illustrates examples of such roadmaps in summary form as used at RMIT University. This roadmap is complemented with more detailed information on the identified technologies, the strategic and operational value they play, and the mechanism for moving technologies through the lifecycle. This type of diagram is an important organizational communication tool, particularly given the normal structural complexities of universities, which often see e-learning activities supported by four or five different service groups in addition to the academics themselves. Coordination of investment and plans is a significant ongoing challenge in this space for all of the universities assessed to date. The other role that roadmaps and their supporting documents provide is in supporting the definition of a 'platform' of standard tools and services that the university expects all courses to have integrated into the learning and teaching process.

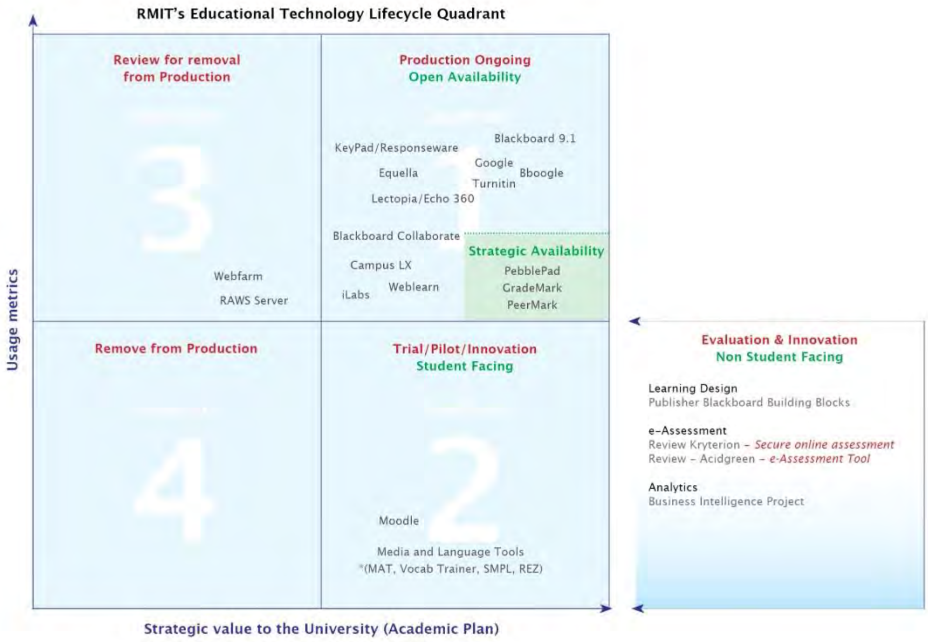

Figure 3: Example of an e-learning technology roadmap

Discussion

The focus of this paper has been on positive examples that can inform improvements in e-learning capability. The intention in so doing to is highlight the role that the eMM, and similar tools including the ACODE benchmarks (ACODE, 2008) and the New Zealand e-Learning Guidelines (Milne & Dimock, 2006) can play in improvement as opposed to the normal rhetoric of quality as a tool for coercion and ranking. Existing resources (http://www.cad.vuw.ac.nz/emmWiki/) provide access to a body of literature that supports the inclusion of specific elements in the different frameworks; the examples included in this paper are intended to support this material by showing specifically what can be done in reality rather than in theory.

Unfortunately, as well as helping identify useful ideas for other universities, the assessments summarized in Figure 1 clearly show much room for improvement. The examples identified here provide specific illustrations of how particular operational activities might be approached, and the deliberate decision has been made to identify the source institutions in order to encourage others to contact the relevant institutions and learn how similar changes can be made elsewhere.

Earlier studies (Marshall 2005; Sero, 2007; Neal & Marshall 2008; Marshall, 2011) have identified issues facing all institutions and generated the six pieces of advice aimed at improving capability (Table 1). The issues that stimulated this advice are also apparent in the new Australian assessments reported in this paper. In sharing some exemplars this paper is hopefully supporting improvements addressing the first and last item in Table 1.

Examining the other items in Table 1 in light of the current work, it is clear that articulating the strategic relevance of investment in e-learning remains an ongoing challenge for many universities. A number of examples were seen of strategies that addressed the development and maintenance of a technical infrastructure, consistent with the intentions reported by Allen & Seaman (2013), but which have failed to integrate the capabilities and affordances of that infrastructure with the strategic objectives of the university. This lack of integration is apparent in documents similar to the roadmap shown in Figure 3, but where there is little evidence of such plans being aligned with measureable strategic goals and objectives for other university activities.

Table 1: Advice for improving capability (Marshall, 2011)

1.	Have a reason for why e-learning is part of the institutions purpose for existence and be able to express this in strategic and operational activities.
2.	Clearly identify the ways existing e-learning support is impacting upon the staff and student experience.
3.	Talk to the teaching and support staff and find out what prevents their making the best use of existing e-learning investments.
4.	Communicate to students the ways that technology will be used to improve their learning experience and help them prepare themselves to take best advantage of the opportunities provided.
5.	Formally assess staff skills in e-learning and target development resources strategically.
6.	Look for ways to reduce the barriers that discourage informal sharing of e-learning resources, starting with open licensing models.

The absence of measureable strategic goals for e-learning perhaps explains the overall weakness in the Management and Optimisation dimensions of the eMM assessments (Figure 1). Very few examples have been seen in the current study of universities engaging in detail with the impact that different technologies are having on the learning and teaching experiences of students and academics. This lack of rich and detailed information on the realities of e-learning may also explain why few institutions have created resources supporting the student's pedagogical experience of e-learning as opposed to their technical experiences, which are comparatively well served. As noted earlier, a similar situation is apparent for staff and complicates the wider uptake of e-learning.

Another weakness is the lack of capability in process D7 "E-learning resources are designed and managed to maximise reuse" noted earlier. Most institutions have systems in place that manage compliance with copyright licenses and use a content management system in their libraries to ensure that resources are used correctly and that reports of usage can be generated efficiently. Few of the universities assessed to date, however, have engaged with other aspects of reuse, including open licensing. Until recently, there was a clear sense that formalized reuse (Wiley, 2000), while having clear benefits in the abstract sense, was failing in reality to deliver on its promise. Newer models of learning using open licenses such as MOOCs (Cormier, 2012; Daniel, 2012) and the OER University (Attwood, 2011) have reawakened interest in the ways that educational materials can be used and reused to support student learning. The lack of engagement with reuse and licensing observed in the assessments, combined with the absence of clearly articulated strategies for e-learning, suggests that these new models are likely to generate more confusion than action (Marshall, 2013).

The last area of potential concern noted in the assessments so far relates to the ability of universities to manage the risks associated with increasing dependence on technology as a medium for education. Recent events in New Zealand such as the Christchurch earthquake (Stevenson, Kachali, Whitman, Seville, Vargo & Wilson, 2011) have illustrated the importance of robust systems capable of supporting ongoing learning and teaching in the face of unpredictable and substantial challenges (Marshall, 2012a). Particularly when support models are dependent on small numbers of specialist staff it is easy to become vulnerable to risks of losing key staff. The rate of change resulting from successful e-learning strategies can also potentially outpace the ability of key systems to sustain that success unless considerable attention is paid to business continuity and risk issues. These problems are likely to further exacerbated when organizational self-analysis and strategic activities are weak, such as has been noted in some of the current assessments.

The current sample of Australian universities, on which this analysis has been based, includes a range of diverse institutions. Using the typology of Marginson and Considine (2000) this sample has four 'gumtrees' and one each of the 'sandstone,' 'unitech' and 'new universities.' Until a more complete sample is obtained it is unclear to what extent the issues identified here are systematically a problem, although the parallels to assessments of international institutions suggest that they may well be. The eMM project is ongoing and the intention is to expand the sample of Australian universities as much as funding and willingness to participate allows.

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The introduction of an online portfolio system in a medical school: what can activity theory tell us?

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In this paper we discuss innovations in the personal and professional development (PPD) curriculum that were introduced at a medical school in a major metropolitan university in Sydney, Australia. The review of the PPD curriculum involved the development of new content as well as the exploration of technologies that could be used to underpin the various collaborative, self-directed and reflective learning activities of the new course. An online portfolio system (PebblePad) was selected as the technological platform to deliver the new curriculum. Student feedback relating to the new technology has been critical and activity theory (AT) is used to broaden our understanding of the wider cultural forces - what we call the 'negative discourse of PPD' - that can potentially shape attitudes to technology and learning in the PPD component of a medical degree.

Keywords: Activity theory, PebblePad, professional and personal development, curriculum, online portfolios, medical education.

Setting the scene

The University of Western Sydney School of Medicine (UWSSoM), established in 2007, is one of the newest Australian medical schools. The medical degree is a five year course with mostly domestic students ranging in age from 18 to the mid-40s although most of the students are recent high-school graduates. There is an equitable gender balance across all five years of the student cohort. During the first two years of the course, students engage in problem-based learning tutorials based at the university and are embedded in the clinical environment for the remainder of the course. As is the case with other medical schools in Australia, UWSSoM is required by the Australian Medical Council (AMC) to implement a PPD curriculum. The PPD theme is one of the UWSSoM's four major curricular pillars and aims to promote a bio-psychosocial model of medical care and to encourage students to reflect on, analyse and critically question how their professional identity is being shaped during medical school and beyond. However, despite the requirement and encouragement for curriculum reform from the regulatory bodies, we have found, similar to many other medical schools, that implementing a professionalism curriculum in the UWSSoM, has and continues to be, highly problematic.

The negative discourse of PPD in medical schools

The medical school curriculum is dominated by the scientific paradigm which exerts a powerful influence on students' conceptualisation of what medicine is and the formation of their professional identity (Waldstein, Neumann, Drossman, & Novack, 2001). The PPD curriculum theme offers another perspective to science, emphasising the personal, the subjective and the socio-cultural dimensions of medicine. Frequently denigrated as “soft” and “subjective,” PPD struggles for legitimacy in the medical curriculum not only amongst students but also the staff of the medical school community. We call this the *negative discourse of PPD.*

The development of the new PPD curriculum

Two years ago, the curriculum design team took over the stewardship of the PPD theme for the first and second years of the course. Aiming to overcome student negativity the team undertook significant curriculum reform based on feedback from both students and tutors. As a result of the redesign process, the curriculum is now delivered via fortnightly tutorials during which students are encouraged to engage in discussions about philosophical, ethical, legal and political issues relevant to the practice of medicine. The tutors’ role is to facilitate student exploration and discussion of the topics rather than to act as content experts. The assessment takes a variety of formats including reflections, research essays, class presentations and creative responses. The new curriculum also reflects a change from a summative approach to assessment to semester-long progressive formative assessment.

A key obstacle, however, to increasing the emphasis on formative assessment is the learning management system of the University of Western Sydney (UWS). The system does not expedite delivery of frequent and continuous feedback from tutors to students so that students’ work can evolve. Nor does it facilitate the provision of peer feedback or provide students with effective tools to work collaboratively on a joint project. As a result, the curriculum was not able to provide students with the opportunity for integrating their self-directed, reflective and collaborative learning practices. The lack of this capacity prompted the search for a delivery platform that would be able to provide these feedback features. The team’s interest in an online portfolio system (PebblePad) coincided with the university’s interest in the evaluation of PebblePad and this system was subsequently adopted to deliver and implement the PPD curriculum.

As part of the introduction of the new technology extensive staff development sessions were held before its introduction where tutors were introduced to PebblePad and the curriculum. The transition to the new delivery platform, however, was not a smooth one and several issues were encountered. These issues are identified below.

Student feedback

During the course of the first semester of its introduction feedback came in two forms. Anecdotal feedback was provided to us via the tutors and the required online survey for the university’s evaluation of PebblePad, which included questions on its support and ease of use, reinforced the nature of the anecdotal feedback that we received. A summary of the survey and informal feedback is provided below.

- The interface was unintuitive and overly complex.
- Navigational steps to complete tasks such as getting templates were confusing - this confusion also created complexity for tutors.
- The value and utility of PebbePad were repeatedly questioned.
- The iPad was unable to render all features of PebblePad (all first year UWS students were given iPads).

These issues, allied with the perception from students that PPD is a soft subject in the context of a medical degree, prompted us to explore theoretical frameworks that might help us to interpret this feedback. Activity theory (Kaptelinin & Nardi, 2006) was selected as a framework that might provide us with the conceptual tools to combine an analysis of the technological issues arising from the use of the PebblePad with the broader discourse of the place of PPD within a medical curriculum.

Analysis of PebblePad in the PPD curriculum with activity theory

Although AT has undergone various iterations since Vygotksy’s early work in learning and psychology (Bakhurst, 2009; DeVane & Squire, 2012), the core idea of AT is that the basic unit of analysis, activity, takes place in a complex environment of interrelated layers through which activity is constituted and mediated. In 2nd generation AT (DeVane & Squire, 2012) these layers are schematically represented in *figure 1*.

AT has been adopted as a conceptual framework to aid in the analysis of complex domains such as schools (Yamagata-Lynch, 2003) and hospitals (Engeström, 2001). Universities are similarly complex entities and the introduction of new technology into a contested component of a medical degree raises questions not only about the characteristics of the technology itself but the social and cultural layers that mediate its use. With this mind, we have used AT to identify the following elements of the system that we are currently investigating.

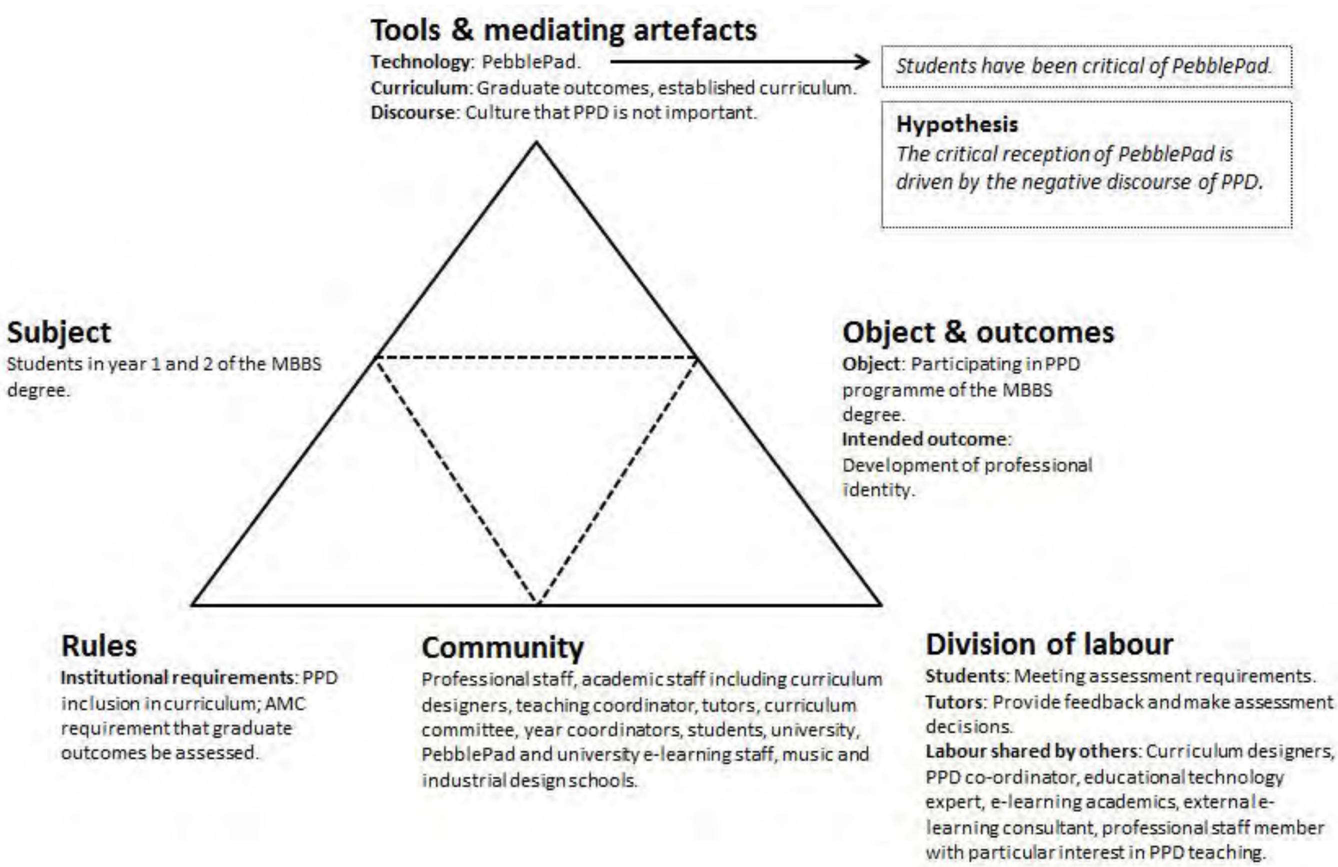
Year 1 and year 2 students are identified as the subjects, their participation in the PPD curriculum as the object and intended outcomes consist of the development of professional identity. Rules of the activity system include the fact that students need to conform to assessment rubrics in order to successfully pass PPD and the fact that they need to study PPD at all is determined by the institutionally-imposed rule from the AMC.

With the division of labour, several people were identified as central to the implementation of the new curriculum and the community consists of organisational units (university) as well as specific people (technical help at PebblePad) that contributed to the new curriculum but were not central to its production.

Following Daniels (Daniels, 2004) the discourse that we have introduced as a *mediating artefact* provides a further level of complexity to the model. In future research we intend to use AT to examine how this discourse has been transformed, reinforced or contested during the introduction of new curriculum and new technology into the PPD programme.

A detailed representation of activity model is provided in *figure 1.*

Figure 1: Detailed description of the PPD curriculum and delivery platform using AT



AT has benefited us in helping frame the adoption of introduction of technology in the context of PPD. Specifically, it has provided a framework which suggests we should consider how a discourse might (negatively) impact on how successfully technology is adopted. As is clear from *figure 1*, however, there are factors other than a discourse layer that may need to be considered in evaluating the adoption and integration of new technology in the present context. For example, in the division of labour as it relates to learning activities, tutors are required to provide ongoing, formative feedback throughout the life of an activity. If feedback is not provided, the pedagogical intent behind learning activities is unlikely to be met and this might have an impact on the value that students place on their use of a novel and complicated application. Further dimensions in the division of labour include technical and administrative components as well as support with online pedagogies from various staff members. In the absence of this level of support, it would be difficult to meet the institutional requirements of the provision of a PPD curriculum as well as the pedagogical objectives inscribed in the PPD curriculum.

Discussion

The student feedback that we have received about PebblePad has been critical and it is clear that students did not embrace the system in the way that was originally intended. It would also seem that the original educational outcomes of the new PPD curriculum have not been entirely met. It is not evident, however, why this is the case. Is student resistance to PebblePad purely a function of technological parameters (interface, usability etc.) or does a complex relationship exist between technology and the negative discourse of PPD? Other factors that mitigate the successful uptake of new technologies by students in a higher education context have also been suggested (Kennedy et al., 2009). Some of these are contextual and specific to a particular discipline - time poor medical students, for example, are only likely to spend time with technologies that are perceived to be useful to their studies - while others relate more to the varying levels of interest, knowledge and ability that students display with particular technologies. In future research it will be important to balance contextual factors such as these against our central hypothesis.

Conclusion

Our analysis of the introduction of PebblePad into the PPD component of the UWSSoM medical degree has been illuminating and the critical reception of the new technology has exposed issues with PebblePad's unorthodox interface. Our adoption of AT as a tool to explore the complex relationship between technology and the factors influencing its adoption led us to pose questions about the introduction of new technology (PebblePad) and the educational framework through which it is mediated, in our case, the PPD medical curriculum. The exploration of the links between the use and introduction of technology and the negative discourse of PPD will inform the direction of our future research.

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An empirically-based, tutorial dialogue system: design, implementation and evaluation in a first year health sciences course.

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This paper presents one possible approach to providing individualised and immediate feedback to students' written responses to short-answer questions. The classroom context for this study is a large first-year undergraduate health sciences course. The motivation for our approach is explained through a brief history of intelligent tutoring systems, the philosophical and educational positions which inspired their development and the practical and epistemological issues which have largely prevented their uptake in a higher education context . The design and implementation of a new empirically-based tutorial dialogue system is described along with the results of in-class evaluation of the new system with 578 student volunteers.

Keywords: Tutorial Dialogue Systems, Natural Language Processing, Formative Feedback

Introduction

In large undergraduate classes, it is time-consuming, costly and seldom practical for the teacher to provide students with individualised feedback on their written responses to questions. Typically, computer-based marking of formative tests is used as an alternative and examples of this include Learning Management System (LMS) based multiple-choice quizzes or similar. The coordinator of a large first-year health sciences class (1500-1800 students) approached the researchers for suggestions about the ways in which technologies might assist students to practice writing answers to short-answer, or constructed response, questions. Anecdotally, students typically performed poorly on these types of questions in the final exam relative to the multiple-choice questions. The course coordinator hypothesised that this was due to the lack of opportunity during the course for students to practice answering such questions: there were simply not enough teaching staff available to provide formative feedback on all the student responses. Intelligent tutoring systems (ITS) which employ natural language as their interface (tutorial dialogue systems) seemed to offer some promise for supporting and enhancing student understanding of key concepts in the current classroom context. The appeal of tutorial dialogue to both teachers and researchers was that formative questions are embedded in a tutorial plan: the questions arise in a meaningful context and concepts and ideas are linked together in a coherent form.

This paper begins with a brief history of intelligent tutoring systems, the philosophical and educational positions which inspired their development and the practical and epistemological issues which have largely prevented their uptake in a higher education context . This leads to the motivation for the current research and a description of the design and implementation of a new empirically-based tutorial dialogue system. The results of in-class evaluation of the new system with 578 first year health sciences students are presented and the paper concludes with a discussion of these results and opportunities for ongoing research and development.

Intelligent tutoring systems: past and present

Jaime Carbonell's *Scholar* (Carbonell, 1970) is frequently cited as the earliest intelligent tutor (see for example, Woolf, 2008; Evens & Michael, 2006; Pea 2004; Shute & Psotka, 1994). *Scholar* produced individualised responses to typed student statements in a specific domain (for example, South American geography) using a semantic network. Carbonell's system parsed natural language input (that is, it could break down a sentence into its component parts and analyse the syntactic role of each part) using a system based on case grammar (Fillmore, 1968). *Scholar* then translated the parsed input into a logical form for processing by a semantic network and generated textual output from pre-written templates which matched specific logical outputs from the semantic network.

From a philosophical standpoint, *Scholar* can be thought of as the prototypical, rationalist inspired ITS. The prevailing approach adopted in the development of ITS up until quite recently has been without a doubt, the rationalist one. By the 1990s and through to the present day, the general architecture of ITS has been resolved to include at least some kind of knowledge base, which might include simulations or an expert system, an expert problem solver (these two together constituting a domain model), a student model, some kind of teaching model (Evens & Michael, 2006), authoring tools to allow teachers, and in particular those without specialist programming knowledge, to create the ITS in context (see Murray (1999)) and increasingly, dialogue modules to facilitate two-way natural language communication (for example, *Why2-Atlas* (VanLehn, et al., 2002), *Circsim-Tutor* (Evens & Michael, 2006))

Several issues arise from the rationalist approach to creating an ITS. First, ITS which utilise deep natural language processing techniques (NLP), involving the creation of domain-specific grammars, are typically very limited in their ability to handle language outside their domain of 'understanding' (Jurafsky & Martin, 2009). Second, the domain of 'knowledge' represented by the system needs to be mapped out and represented in some way. Third, some way of modeling student and tutor actions is usually required (Woolf, 2008). Finally, significant analytical effort is required in order to build an ITS even in a very restricted domain and even if authoring tools are available (Murray, 1999).

By contrast, the empiricist approach to building an ITS involves taking linguistic input from the tutee and looking up the most appropriate linguistic response based on empirical evidence about how to respond. Manning & Schutze (1999) characterise the empiricist 'camp' as privileging sensory input over mental organisation and contrast this to the rationalist position which emphasises innate mental structure over sensory input. Statistical or surface-based, NLP techniques are used to "understand" student input. Statistical NLP techniques are increasingly finding utility in practical applications where traditional NLP methods fail (Manning & Schütze, 1999) and are relatively straightforward to incorporate into new applications using standard NLP libraries. In the last 10-15 years surface-based dialogue systems or conversational agents have begun to appear and a few ITS do use surface-based techniques (for example, *Auto-Tutor* (Graesser et al., 2001) or a combination of surface and deep NLP (for example, *CarmelTC* (Rosé et al., 2003)) for natural language understanding. However, even these ITS still retain domain and student modeling. In a "pure" empiricist design, no calculations or assumptions should be made about either mental or machine state; there are no rules. If a particular linguistic pattern or feature-set has been seen before then the machine should respond on the basis of a known response to that pattern; if not, it makes no assumptions and simply says (or types), 'I don't know'.

The motivation for ITS

Even if rarely found in educational practice, ITS have persisted in the research domains of cognitive science and educational psychology. In looking for a reason why this might be the case, no reviewer exploring the ITS literature could fail to notice the impact of Bloom's 1984 study and what has become known as the 2 sigma problem. The Bloom (1984) study (1854 citations according to Google Scholar at June 24, 2013) claimed an effect size (ES) of 2.0 for human 'expert' tutoring and is regularly cited in the ITS literature and textbooks not only as the benchmark against which machine tutors should be compared but also as the reason why the provision of individualised support is a worthy goal. (For example, Woolf, 2008; Evens & Michael, 2006). However, similar studies to Bloom's demonstrate less impressive and highly variable effect sizes. Cohen, Kulik

& Kulik (1982) reviewed 52 studies, found an average effect size of 0.40 and noted that the size of the effect varied widely, the largest being 2.3. More recently, VanLehn (2011) found an average effect size of 0.79 when he reviewed 10 studies comparing human tutoring to no tutoring (ES ranged from -0.24 to 1.95) and an average effect size of 0.76 for step-based (ITS) tutoring compared to no tutoring (29 studies where ES ranged from -0.32 to 1.35). It is not that human tutors cannot be as effective as Bloom claimed; in a few documented instances they have been. Similarly, in some instances, ITS have demonstrated large effect sizes and a few are used, or have been used, in real class settings. However, on the basis of the evidence above it is clear that both human tutors and ITS vary widely in their effects and they do not consistently produce strong positive effects.

Given the wide variability in reported effect size, perhaps it is time to resist the rationalist urge to benchmark ITS against human tutors. The focus could usefully shift to delineating which tutoring or teaching practices or conditions produce the greatest learning effects. Indeed, there are already a number of researchers who are doing just this (see for example, Chi, 2009; VanLehn, Jordan, & Litman, 2007; Chi, Roy, & Hausmann, 2008). In a similar vein, Tamim, Bernard, Borokhovski, et al. (2011) have argued that a more nuanced approach would also be helpful in studies which look at the effect of computer aided instruction (CAI) rather than continuing comparisons between human and automated efforts.

The response of educators to ITS

A specific and important objection from educators, as well as from some educational psychologists and scholars working in the ITS domain, relates to the use of student models in ITS, where the steps taken by the student to solve a problem are compared to those used by an expert and the departure from expert steps or rules is modeled as errors. Laurillard (1988) presents a compelling case for abandoning models of student errors and argues that teaching should move beyond treating problem solving procedures 'as a set of uninterpreted rules'. Scardamalia et al. (1989) suggest that it is "not the computer that should be doing the diagnosing, the goal-setting and the planning, it is the student" (p.53). An entire volume contrasting the "modelers" and the "non-modelers" was published in 1993 (Lajoie & Derry, 1993).

Perhaps because of these doubts which were raised during the 1980s and early 1990s and perhaps because as previously noted ITS seldom find utility in educational practice, it is hard to find much reference to ITS in mainstream educational technology literature, including in the *ascilite* and *AJET* archives. As Reeves & Hedberg (2003) point out, "even the staunchest proponents … of ITS must acknowledge the lack of impact these computer-as-tutor applications have had on mainstream education and training"(p.6). However, if the focus is shifted to educational feedback, of the kind that human teachers and tutors provide, then searching the educational literature provides a good deal of information which is relevant to the design of ITS.

The positive benefits on student performance of formative assessment have been demonstrated in classroom studies since the 1920s (Frederiksen, 1984) and similar positive effects have been demonstrated in psychology laboratory studies since the 1970s (McDaniel et al., 2007). The large scale meta-analysis of studies which investigate the impact of practice tests on student outcomes indicate that on average, practice assessments during a course of study do confer an advantage (Bangert-Drowns, Kulik, Kulik & Morgan, 1991). More recently, a meta-analytic educational study to identify the key mediators of learning outcomes, found that feedback from student to teacher and from teacher to student, are among the top-ranked mediators (Hattie, 2009). In general, non-graded individualised feedback which avoids personal comment (including praise) and which highlights strategies for improvement, results in the largest gains (for example, Hattie & Timperley, 2007; Lipnevich & Smith, 2009; Shute, 2008).

The motivation and teaching context for this research

The first year health sciences course at the University of Otago is a prerequisite for entry into all the professional health science programmes, such as Medicine, Dentistry, Pharmacy, and Physiotherapy. Entry into these professional programmes is highly competitive and is dependent, amongst other things, on students achieving excellent grades in their 1st year courses.

The problem of providing individualised feedback to large numbers of students on free-text answers to formative questions was a key motivating factor for this research. Teaching staff involved in the course were keen to support the research and a bonus was that there was a very large cohort of highly motivated students potentially available each year to work with the system during design, implementation and evaluation. The specific domain selected for researching automated tutorial dialogue was the first year undergraduate study of the human cardiovascular system, in particular, cardiovascular homeostasis. There were two reasons for this choice. Firstly the domain was the same as at least one other natural language tutor, *Circsim Tutor* (Evens & Michael, 2006), although pitched at a more introductory level. This was helpful in that it provided some confidence that the domain was suitable for automated tutorial dialogue. Secondly, it was a domain familiar to the lead researcher and thus obviated the need to find additional staff for authoring of the tutorial questions and script.

Given the large body of evidence for the beneficial effects of formative feedback, given the practical problems associated with current rationalist inspired ITS, the issues associated with student modeling, and finally, given the desire by educators for individualised, intensive and relevant learning environments, we felt it was worth adopting an empiricist approach to the design and implementation of a new system. The system emphasises utility in practice, no student model and categorisation of actual student responses and is described in the next section.

A new surface-based tutorial dialogue system

Overall design goals

The new tutor had to be responsive and practical in a real class setting. With this in mind, the broad design specification for the new surface-based tutorial dialogue system was as follows:

- The natural language understanding (NLU) component of the new system relies on empirical or statistical NLP techniques rather than deep semantic NLP techniques. This choice, in addition to sitting well with the empiricist philosophical position is also a pragmatic one; statistical NLP techniques which utilise machine learning are increasingly finding utility in practical applications where traditional NLP methods fail.
- The new tutor abandons the idea of explicit student models, pre-ordained teaching models and any formal or logical representation of the knowledge domain. But, it does retain the idea of unrestricted free-text input from the student. The family of dialogue systems or conversational agents closest to it, are those inspired by Weizenbaum's 'psychotherapist', ELIZA (Weizenbaum, 1966). These dialogue systems or conversational agents, which are not necessarily designed for tutoring, take typed natural language input, attempt to classify the input based on either regular expression matching or surface-based NLP techniques and generate typed output from a pre-defined script.
- Ideally, given the difficulty and expense of authoring, or customising ITS for specific contexts, a generic tutorial dialogue structure which is based on existing models of human dialogue should be designed into the new system in order that it can be readily extended or customised in the future.

Prototyping and data collection

The first stage of the project involved producing a detailed set of questions to probe student understanding of key elements of the tutorial domain and evaluating these questions, in the form of a scripted dialogue, with students. The TuTalk dialogue engine from the Learning Research and Development Centre at the University of Pittsburgh (Jordan, 2007) was chosen to pilot the initial script primarily because it was, at the time, one of the few readily available domain-independent tutorial dialogue systems and provided a relatively easy way to author dialogues using only a text editor.

Questions for the initial cardiovascular homeostasis tutorial script were developed in close consultation with course teaching staff and were written using lecture notes, laboratory manuals and self-directed learning material from the course itself. A prototype tutorial system based on the script, and which included 'guessed' student answers to match student responses against, was released to students for use on a voluntary basis at the beginning of their module on the human cardiovascular system. 437 students accessed the system during the course and produced a total of 532 dialogues; several students accessed the dialogue more than once. However from the total number of dialogues, only 242 dialogues were completed through to the half-way point and only 127 dialogues were completed to the end. A handful of dialogues were interrupted because of system-related problems but the majority that terminated before completion did so because because the students simply ended their session. Feedback from course tutors and comments from the students themselves supported researcher inutition that poor system understanding of student dialogue contributions was probably a key reason for the fall-off in use. This was confirmed when accuracy, precision and recall measures for individual questions were calculated: apart from a handful of essentially yes/no questions the majority of these metrics were zero. Nevertheless, the exercise served its purpose in capturing a large quantity of student responses to tutorial questions. These were to serve as training data for the next stage of development.

Creating the dialogue and building the new system

The next stage of the project involved creating categories of student responses from the responses collected during stage one in order to train statistical machine learning classifiers to recognise new student responses. In addition, the script developed in the first stage was refined in order to deal appropriately with the newly created categories of response. This process is described in detail elsewhere (McDonald, Knott & Zeng, 2012) but broadly parallels methods which are very familiar to educational researchers using qualitative research methods, (for example, phenomenography (Marton & Saljo, 1976) for identifying student conceptions or the methods of content analysis (Stemler, 2001)). This approach to creating categories or themes from student responses, is far less common in the realms of ITS development.

The overall architecture of the new system revolves around a dialogue manager which consults a hand-crafted script in order to direct the dialogue. The dialogue manager implements a simple finite-state architecture with a minimalist representation of information state (Traum & Larson, 2003). The script structure is loosely based on the Core & Allen (1997) dialogue coding scheme where each dialogue contribution node is divided into forward and backward functional layers. Each contribution node in the script contains forward and backward elements and each of these contain relevant dialogue acts or directions for action (for example, a request for information or a directive to go to a specified contribution node). The script is an XML file which is defined in the XML schema for the dialogue system and which comprises a series of dialogue contribution nodes. This design is based on a combination of practical and theoretical concerns. First, the finite-state approach is one of the simplest dialogue management models to implement and this was important in terms of developing the system in a timely manner and in such a way that it was robust enough to use with a large class of students. Second, the finite state approach is consistent with the directed nature of a tutorial dialogue where the dialogue purpose is to revise a specific and well-defined area of the curriculum. Third, the single-initiative question-asking approach provides an opportunity for students to practice tasks they are expected to complete as part of their formal summative assessment. (Note that limited mixed-initiative ability – i.e. the ability for students to ask questions – is built into the system but this was not evaluated as part of this research.)

The dialogue manager passes preprocessed text input from the student to the classifier module and receives back the result of classification which is either the name of the class chosen for the current dialogue context or a flag that classification failed. (Input text is preprocessed to isolate meaningful words or tokens and correct for spelling errors, identify abbreviations and so on). The dialogue manager then consults the script to determine what response to send back to the student. Both the preprocessor module and the classfier module utilise NLP libraries which are available in the Natural Language Toolkit (Bird et al. 2006). Specific implementation details are described elsewhere (McDonald, Knott & Zeng, 2012). The next section describes how the system works in practice, describes the types of questions included in the present dialogue script and briefly summarises the results of bench-testing the system for understanding of previously unseen input.

Dialogue walk-through, question-types and classifier performance

Students connect to the system via a simple chat-style web interface. The system types out statements and questions and the student responds by typing into a dialogue box. The system always waits for a student response before continuing. The following is an excerpt from a real dialogue session between the system and a student. The excerpt begins with an assertion from the tutor:

> TUTOR: Stroke Volume (SV) is the volume of blood ejected from the heart with each beat. The average adult heart pumps a total of 5 litres of blood each minute, and the average adult heart rate is 72 beats/minute.

The tutor then asks the student to perform an action which is directly related to this information:

> TUTOR: Please calculate the stroke volume for an average adult.

The student's initial response to this is:

> STUDENT: 5000/72

The student has not included the units for stroke volume which even though not explicitly requested, have been modelled by the tutor. The tutor recognises the student's response is numerically correct and responds with an acknowledgement of the student input followed by some scaffolding:

> TUTOR: OK. Looks like you have the right idea but you have either forgotten to give the units or used the incorrect units. Remember you can work out the correct units to use like this: You are given HR (beats/minute) and CO (l/minute). SV = CO/HR which is l/min divided by beats/min = l/beat. Finally don't forget to multiply the result by 1000 in order to convert l/beat to mls/beat.

Next, the tutor asks the student to try again and repeats the question:

TUTOR: Try again. Please calculate the stroke volume for an average adult.
This time the student responds with the same answer they produced the first time but this time in decimal form:
STUDENT: 69.4
Once more, the tutor recognises that the units are missing but this time responds slightly differently. The problem with the student's answer is again stated explicitly but detailed scaffolding is not included since the tutor also indicates that the problem is the same as the student's previous attempt:
TUTOR: Again, looks like you have the right idea but you have either forgotten to give the units or used the incorrect units.
And, once more the tutor repeats the question:
TUTOR: Try again. Please calculate the stroke volume for an average adult.
This time the student provides the correct answer with appropriate units:
STUDENT: 69 ml
The tutor provides positive feedback before moving on to the next dialogue context:
TUTOR: Well done.

This excerpt from a dialogue session illustrates three important features of tutorial dialogue. First, the student in this situation is not initially responding directly to the feedback given. It seems as though some other thinking is going on which results in the same answer being repeated, but just expressed differently. Feedback has to be noticed in order to be responded to. Second, if the dialogue is to be believable, the tutor has to respond appropriately where the same question is repeated. This finessing is one of the features of human dialogue which sets it apart from machine-speak. Humans typically will not just repeat the same utterance over and over, nor should the tutor. This feature is achieved through keeping track of the current dialogue state. Third, there are many ways that students might express the answer to this particular question – the tutor needs to be able to recognise most, if not all of them, in order to provide appropriate feedback. Another common error in this dialogue context for example, was problems with algebraic manipulation. The feedback if this were the error is different but the tutor action is the same: the student is asked to try again, and the question is repeated.

There are three broad categories of question-type in the tutorial dialogue script. These are binary, multi-part and open. In brief, a binary question requires exactly one response, usually just a word or two, and the response is either there or it is not. Yes/No questions are good examples of a binary type question. By contrast, an open question is one which requires some kind of development of ideas; for example making an inference, justifying a choice, applying a principle, or as in the example above, performing a calculation. It requires much more than a simple yes or no response or restatement of facts. Multi-part questions are those where several specific components or features are required in the response. For example, a question beginning with 'List 3 variables . . . ' is likely to be a multi-part question.

In all there are 29, what might be termed, top-level questions in the dialogue script. Requests to repeat questions and fall-back yes/no questions which are used where classification fails, are not included in this number. In laboratory tests which were conducted before the system was released to students, the accuracy on held-out unseen data for 26 top-level question classifiers ranged from 0.75 to 1.00 with the median value at 0.95. Of these classifiers, 13 were for binary-type questions and as might be predicted, the accuracy for recognising previously unseen responses to these tended to be towards the higher end of the range. Conversely, the accuracy of classifiers for open questions, such as, "What is the pulse?" or "Can you explain why you cannot feel a pulse in someone's vein?" tended to be at the lower end of the range (in this case, 0.75 and 0.85 respectively). The three remaining top-level questions were multi-part and the performance of classifiers for these is measured using a different metric (Measuring Agreement on Set-valued Items or MASI distance, where 0 indicates complete agreement between the class labels assigned to the reference and held-out data sets and 1 indicates no overlap. (Passoneau, 2006)). MASI distance for these classifiers ranged from 0.04 to 0.23.

While these "bench-test" results are promising and consistent with results using surface-based NLP techniques to recognise responses to short-answer questions (see for example, Butcher & Jordan, 2010) there is room for improvement. Nevertheless, the results were convincing enough to proceed with an in-class evaluation of the new tutorial dialogue system. Furthermore the design of the dialogue manager was conservative in that it always preferred an "I don't understand your answer" response and a fall-back yes/no question, where the confidence level of the classifier result was doubtful. The results of the in-class evaluation are described in the next section.

In-class evaluation

The goals of evaluating the tutorial dialogue system were twofold: first, to evaluate the system performance in terms of a) its ability to recognise and respond appropriately to student input, and b) the student experience of using the tutor; second, to formally test a set of hypotheses involving student use of free-text and menu-based versions of the tutor. In order to test the hypotheses a menu-based version of the tutor was created. This was identical in every respect to the free-text version described in this paper except that instead of typing their responses to questions, students chose their preferred option from a menu. The menu reflected exactly the same classes of response that were available to the question classifiers which were used in the free-text version of the system. The hypotheses we tested were:

1. Either tutorial intervention, free-text or menu-based, results in better performance on a post-test than no intervention.
2. Free-text input results in better post-test performance overall than MCQ, because construction of a textual response from scratch requires first, recall of the relevant material and second, active processing of this material. Construction of responses should therefore promote retention and/or understanding better than simply selecting from pre-constructed options.
3. Free-text tutorials lead to increased performance particularly on short-answer questions because of a practise or testing effect.
4. MCQ tutorials lead to increased performance particularly on MCQ questions, also because of a practise or testing effect.

Background and experimental method

One of the researchers and the lecturer for the cardiovascular physiology section of the course introduced students to the experiment and the dialogue system during the last lecture on the cardiovascular system. A recording of the lecture was also available for students to access online from the following day. A web-page link for the tutorial dialogue system was also provided to all students via the course LMS. Prior to logging in to the tutorial dialogue system students could read the background to the research and experiment. Access to the tutorial dialogue system was taken as consent to participate in the study. Students could login any time during a three-week period that began immediately following the lecture in which the system and its evaluation was introduced. The three-week period coincided with the laboratory and self-study periods assigned to the cardiovascular system and ended on the day of a summative multiple-choice terms test designed to examine student understanding of the cardiovascular section of the course.

Evaluation criteria

Appropriate recognition and response to free-text student input was evaluated at the conclusion of the study. Preliminary results are reported in the next section for a small sample of four classifiers. Two human markers independently classified a sample of 100 student responses for each of these four classifiers. Marker classification was checked for inter-rater reliability and compared with system classification.

Student experience of the system was evaluated through a combination of student uptake and completion of the tutorial and administration of a student experience questionnaire which consisted of six 5-point Likert-scale questions, a section for free-text comments and one yes/no question. In addition, any unsolicited e-mail feedback from students was recorded.

In order to test the hypotheses an experimental study design was used. Student volunteers were randomly assigned to one of three conditions:

- A free-text condition where students complete a pre-test, then the free-text version of the tutorial dialogue, and conclude with an immediate post-test;
- a menu-based condition where students complete a pre-test, then the menu-based version of the tutorial dialogue, followed by an immediate post-test, or
- a control condition where they simply complete pre- and post-tests.

Performance in each condition was evaluated by:

1. Normalised score on an immediate post-test (conducted straight after the intervention or the pre-test for the control group) minus normalised score on pre-test. The immediate post-test comprised 7 MCQs and 7 short answer questions.
2. Normalised score on a delayed post-test comprising 3 MCQs, short-answer questions and a mini-essay question from the cardiovascular section of the final examination for the course.

Evaluation results

Overall, during the three week period in which it was available 720 students from a class of 1500 logged into the experimental system. Of these, 578 students completed the session through to the end of the immediate post-test. However, at completion of the study all student data recorded by the system as complete was checked. Following this process, 47 student sessions were removed from the analysis because of web browser or connection timeout issues. The final number of completions included in the analysis therefore was 531. The highest number of completions was 205 in the control condition, followed by 177 in the menu condition and 149 in the free-text condition.

While bench-testing of classifiers yielded promising results across all three types of classifier question (open, binary and multi-part), preliminary evaluation of four representative classifiers used in-class suggests a dramatic performance reduction for all but the binary question classifiers. Accuracy for 2 open question classifiers dropped from 0.8 and 0.9 on bench-testing to 0.61 and 0.65 in-class respectively. By contrast accuracy on a binary question classifier dropped from 1.0 on bench testing to 0.97 in-class. The multi-part question classifier also fared rather poorly increasing from a MASI distance of 0.23 on bench-testing to 0.68 in-class. There are several possible reasons for the drop in performance. An important one is that while the curriculum remained essentially the same between the collection of training data and its application in the tutorial dialogue system, any subtle change in emphasis from teaching staff could result in a drop in classifier performance. In fact, there was one change of lecturer during this time and this would have the potential to introduce new language, new expressions and new emphasis for the students. The reduced performance of the multi-part question classifier was likely due to limited training data (the more parts to a question, the more it is helpful to have larger data sets) and a potential class-imbalance problem (see for example, Japkowicz (2000)).

Nevertheless, in spite of the drop in performance of the free-text classifers, there seemed to be little subjective difference as far as the students were concerned between the free-text and menu-based conditions. A total of 105 responses to a student experience questionnaire were received (23% of the total number of students who logged in to either tutorial condition). Of these responses, 47 were from students who had been assigned the free-text tutorial and 58 were from students assigned to the menu-based condition. This response rate is consistent with large class evaluation response rates processed by the Evaluations Unit at the University of Otago but at the lower end of the range (typically 20-30%). The most striking feature of responses to the questionnaire was that 94% of all those who responded indicated that they would recommend the tutorial to other students. This feed-back is consistent with the 80% completion rate of those who participated in the evaluation, the 78% positive rating of the tutorial as an aid to learning and the 73% positive rating of the tutorial as a revision tool. There were a total of 38 free-text comments provided on the questionnaire. Eight responses related to reasons for non-completion. Three of these cited technical issues and two suggested either the tutorial was too long or that the student had insufficient time to devote to it. One student noted that they did not find the tutorial helpful and one felt that the tutor did not properly understand their answers. There were 30 general comments. These were predominantly complimentary and/or positive about the tutorial (19). Five found the tutor frustrating or felt their responses were poorly understood by the tutor. Other key themes from student suggestions and comments included: supporting media (e.g. video) would be helpful (2) Technical issues (2) More questions and/or more depth to questions (2) Tutor questions hard to understand (2) Tutorial patronising (1) Abbreviations not explained (1) Tutorial too long/lack of time (1). Unsolicited feedback was received from 6 students. Their comments were largely positive and provided useful validation of the feedback solicited via the student evaluation questionnaire.

The dependent variable to test the first hypothesis, which was that either tutorial condition should result in a performance gain over the control condition, was taken as the difference between pre- and post-test performance for each student with the pre-test result serving as a common baseline in each case. The differences between pre- and post-test scores were normally distributed. A between-subjects ANOVA gave an F value of 3.73 and a post-hoc Tukey multiple comparison of means at 95% confidence level showed a significant difference when compared with the control for the menu-based tutorial condition ($p=0.039$) but just outside significance for the free-text condition ($p=0.076$). On this basis, the first hypothesis is only supported for the menu-based condition. However, further investigation revealed that significant differences at the 5% level between both conditions and the control did exist up until 2 days before the end of the experimental period. At this point large numbers of students opted to take part in the evaluation and for this group there was no significant difference between tutorial and control conditions. In other words, scores in the control group increased on average as students studied towards the terms test and the effect of completing either tutorial when combined with intensive study confers no additional advantage. Linear regression analysis of scores in each condition confirmed this ($p < 0.05$ for both slope and intercept).

None of the remaining hypotheses was supported. There was no support for the second hypothesis that free-text input results in better post-test performance overall than menu-based input; comparison between the mean scores for free-text condition and menu-based condition was not significant (p=0.987). There was also no demonstrated benefit for free-text tutorials improving scores on free-text questions in the immediate post-test nor multiple-choice questions improving immediate post-test performance on the MCQs. Finally, when looking at the results of the delayed post-test, in this case, MCQ, short-answer and mini-essay questions from the final examination, approximately 3 months later, a between-subjects ANOVA gave an F value of 0.41. A post-hoc Tukey multiple comparison of means at 95% confidence level showed no significant difference when compared with the control for either the menu-based tutorial condition (p=0.99) or for the free-text condition (p=0.66).

Overall, the most striking result from the experiment was the lack of difference in student performance between the free-text and menu-based groups. This finding is consistent with studies where differences in performance between free-text and menu selection has been specifically examined (Corbett et al., 2006; Aleven et al., 2004). Either of these tutorials has a clear positive benefit on immediate post-test scores but this effect is, perhaps unsurprisingly, diluted by additional study as students work towards a summative terms test. There was no discernible effect on delayed post-test but given the relatively brief nature of the intervention, it would have been remarkable indeed to see an effect as highly motivated students prepared themselves for a critical examination!

A future for tutorial dialogue systems in contemporary educational settings?

The results reported here are the first from what we hope will be many in-class studies conducted using this tutorial dialogue system and others like it. Certainly a request has come this year from teaching staff for the cardiovascular homeostasis tutorial to be made available again. There are many issues to address and some of them have been touched on in this brief paper. Some of these are technical but the purpose of this paper is not to highlight these. There is room to improve the language recognition or text classification part of the system and perhaps this alone may result in greater learning gains from a free-text input system. Another key issue is setting the system up so that teaching staff themselves can create the dialogues. But perhaps most important is the opportunity to automatically classify student conceptions or understandings of aspects of the curriculum so that teachers can identify what these are and teach directly to them. It is interesting to note that this general idea is also gaining prominence through the emerging field of learning analytics.

In addition to the provision of practice and what is, on the basis of this study, an engaging tool for students, there is also the opportunity to give teachers practice at asking deeper and more difficult questions; writing questions and providing feedback to questions which encourage and support understanding rather than the simple repetition of facts. After the fact examination of our immediate post-test questions, which were prepared in consultation with teaching staff, revealed that they arguably only tested the surface recall of facts, even though some were open-ended questions. This is a well documented problem both globally (Frederiksen, 1984) and locally (Walker et al., 2010) and future work will need to address this.

In many large classes, as the teaching staff who approached us suggested, it can be all but impossible to find opportunities to provide feedback to short-answer questions, except perhaps during the final examination by which time it is too late for many. Through use of systems like ours, not only is there the opportunity to manage and evaluate large quantities of question and response data, it is presented and managed in a coherent form. The very nature of a tutorial dialogue does not lend itself to the mere presentation of isolated facts: ideas are presented in context and there is an internal coherence. We have demonstrated in this paper that there is both a benefit to students and an appreciation from students for the two versions of the tutorial dialogue system, free-text and menu-based. It remains to be seen whether there will be a discernible difference between the two.

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Engaging online students through the gamification of learning materials: The present and the future.

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The benefits of gamification in learning and instructional design to help engage and improve student learning online are investigated in this paper. The use of scenario-based learning and alternate reality gaming (ARG) are identified as key representations for improving user engagement, productivity and help shift away from classroom based learning activities towards fully self-paced and collaborative online activities. The paper outlines the reasoning behind, and the advantages of, using scenario-based and alternate reality gaming as an instructional tool in tertiary online education.

Keywords: Gamification, Scenario-based Learning, Learning Design, Alternate Reality Gaming, User Engagement

Introduction

Recently, there has been an efflux in "gamifying" education, or presenting course content in a game-like context to motivate learners to engage with the material (Pappas, 2013). Gamification is using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning and solve problems. Games have been suggested to provide more effective learning by bringing more fun, appealing, and learner-centred environments (Ebner & Holzinger, 2007; Prensky, 2001). Gamification is still a fairly new in higher education, but it builds on the success of the gaming industry, social media and decades of research on human psychology (Werbach, 2013). Many on-the-job training programs are already encouraging the use of game strategies to make work and study more engaging, rewarding and applicable (Pappas, 2013). This paper looks at the adoption of game thinking in e-Learning for higher education and the effectiveness of using game techniques to help stimulate learning and encourage student engagement.

The benefits of gamification in online learning and teaching

As Werbach (2013) identifies, effective gamification is not layering goals and rewards on top of content, rather, it involves adopting a game thinking mentality in order to integrate game mechanics into learning in a planned approach. Effective games influence both psychology and technology, in ways that can be applied outside the environments of games themselves. Game thinking includes more than just a badge system and leaderboards; it requires a thoughtful understanding of motivation and design practices (Werbach, 2013). The structure of an online course, including the navigational interface, visual design of materials and information, as well as the communication tools to facilitate learning, can affect students, instructors, programs and educational organisations in various ways. The structure and design of online courses can have an impact on the student learning outcomes, instructor evaluations and instructional decision-making and reputation (Lee, Dickerson & Winslow, 2012). When gamifying a course for distance education the ultimate goal in game thinking is to create positive learning outcomes while students are committed and stimulated with the learning materials online. As stated by McGonigal (2011) we live in a world full of games, more than 31 million people in the UK alone are gamers with the average young person spending 10,000 hours gaming by the age of twenty-one . By using game mechanics, educational practice can transition from a lecture to an interactive and engaging activity (Pappas, 2013). Research shows new generations of students are fundamentally different from former generations, mostly because of changes in their media consumption patterns (Bourgonjon, Valcke, Soetaert & Schellens, 2009). This generation of students grew up using hypertexts, social networking sites and video games. Thus it is argued that these students have gained specific technical skills, new ways of thinking and different learning preferences, which require a new educational approach (Oblinger & Oblinger, 2005; Prensky, 2011; Bourgonjon et al, 2009). An essential component of facilitating learning is understanding learners. The learning styles, attitudes and approaches of high school students differ from those of twenty-two year old university students (Oblinger, 2003).

To help cater for different learning styles and those new to contemporary pedagogy, instructors and instructional designers need to effectively use elements of gaming in an educational context. This can be achieved with the use of scenario-based learning and alternate reality gaming (ARG) to help aid in the delivery of online content. Many theories have been suggested to account for the positive effect of games in learning. One is that, in order to move to higher levels of play, games require individuals to use prior knowledge, transfer new information into new situations, apply information in correct contexts, and learn from immediate feedback (Oblinger, 2004; Ozelik et al., 2013). One of the reasons for individuals preferring to learn through games may be their optimal flow experiences and their motivation on playing games (Squire, 2003). While playing games people usually spend considerably longer time-periods in the subject of the game. They tend to enjoy the environment and have higher levels of motivation to remain in such environments (Ozelik et al 2013). This concept has been elaborated by researchers of the flow theory.

Csikszentmihalyi (1993) defines flow as ‘a state of consciousness that is sometimes experienced by individuals who are deeply involved in an enjoyable activity’ that is the key to successful gamification. When people are in the optimal flow experience, they are in such a psychological state that, during the activity, they do not care about their environment (Intal & Cagiltay, 2007; Killi, 2005; Ozelik, et al.,2013). Players temporarily lose track of time, surroundings, and the actual environment that they are in. Studies show that participants perceive higher levels of flow, and apply in-depth problem solving strategies with computer games (Liu, Cheng & Huang, 2011; Ozelik et al., 2013). The sense of competition and feeling of closure once the problem is solved and a level is complete, is far more powerful than anticipated. Gamification isn’t solely about competition; it’s about developing skills throughout each level. Student interaction with the materials, unlocking new problems, levels and boards based on their performance allows self-paced learning and self-gratification (Pappas, 2013). This game-based platform interlinked with explanations of solutions, synchronous feedback and dashboards that track student progress makes the experience much more pleasing. This interaction between the student and their learning materials creates a collaborative and constructive learning experience creating opportunities that integrate thinking, feeling and action.

As noted by Thomas & Brown (2011) gamified learning is in the early experimental stage incorporating such ideas into an online course is no easy task and while e-Learning research and methods are slowly evolving the use of game-based platforms and technologies are becoming more popular. E-Learning incorporates computer-assisted learning tools such as stand-alone computer-based training programs, materials, and exercises, as well as those that are accessed through the internet (Wankel, Marvoich & Stanaityte, 2010). The use of game-based systems are customisable, individually (or instructor) paced, interactive platforms (Wood, Solomon, Marshall & Lincoln, 2010). They are useful for helping bridge the gap between classroom theories and the real world. Reports from the corporate world suggest that the use of game-based learning results in a knowledge transfer four times greater, and in knowledge retention ten times greater, than traditional methods (“Total Learning”, 2008; Wankel et al., 2010). In the next section an example of scenario-based e-learning incorporated into an undergraduate finalcial accounting subject is described.

Scenario-based e-Learning

Scenario-based e-learning design processes are based on an asynchronous mode of delivery, where learners interact with the course material and each other independently. This adds constraints to the delivery component, as instructors must create courseware that is engaging without the benefit of real-time interaction. They must also work with available technology, which limits decisions about delivery (Iverson & Colky, 2004). The second unique aspect of this model is that it involves course design featuring one or more goal-based scenarios, where learners pursue an object by practicing key skills and using content knowledge (Schank, Berman, &

Macperson, 1999; Iverson & Colky, 2004). The principle behind scenario-based learning is that a good program consists of a story in which students play a key role – the role that the student might perform in real life or might need to perform in the future (Iverson & Colky, 2004). Students are placed in a realistic scenario, where they take on the key role of the protagonist.

After researching the advantages of scenario-based learning as an instructional tool, we developed this approach in an undergraduate financial accounting subject at the University of New England. Within this subject students assume the role of an 'accountant' and undergo tasks and problems that an accountant would stumble across in the real world. The work may be done individually or in a team environment, allowing a richer learning experience. Supporting materials and resources may be provided, and online mentors may be available to answer questions and provide guidance as needed. As students work through the scenario to achieve their mission and goals, they learn the critical skills required to accomplish their tasks successfully. Since the scenario problems are based on authentic, work-based challenges, the transfer to the work environment is seamless (Iverson & Colky 2004). The platform aims to overcome criticism of undergraduate financial accounting education as being too abstract and theory driven. In addition, undergraduate students often perceive financial accounting subjects as difficult, formalistic and unattractive.

Through the use of gaming techniques, in which students interact with academic materials by working through a trimester long interactive story, set in a virtual business, the use of a scenario-based gaming environment for this subject has resulted in a shift away from classroom based learning activities towards fully self-paced online activities which are integrated into the underlying interactive story. The interactive learning environment also enables the use of targeted early intervention strategies (both automated and manual) as the progress of individual students is monitored continuously. Evidence was collected via an analysis of formal subject and teaching evaluations provided by students, and a survey which evaluated the perceptions of students in regard to the utilised gaming environment. Overall, the collected evidence indicates that students perceive the scenario-based gaming environment as engaging and useful for their learning. In addition, overall student performance in the subject for which the scenario-based gaming platform was adopted improved considerably whilst academic rigour was maintained.

The notion of e-learning adds the additional components of an engaging story communicated via electronic delivery, enhanced by virtual communication and an extensive knowledge base (Iverson & Colky 2004). Current students gaining entry into university either use, or have used games once in their lives. This may include social networking games, game-based phone applications used between friends, online gaming and even competition based games to win prizes. It is then no surprise for instructors to consider game-based approaches to help facilitate online learning. Alternate Reality Gaming (ARG) is an exciting new medium, a genre that blurs the boundaries between producer and consumer that fosters a more participatory popular culture (Ornebring, 2007).

The Future: Alternate Reality Gaming (ARG)

According to McGonigal (2004) the definition for Alternate Reality Gaming (ARG) is an interactive drama played out online and in real-world spaces, taking place over several weeks or months, in which dozens, hundreds or thousands of players come together online, form collaborative social networks, and work together to solve a mystery or problem … that would be impossible to solve alone. As argued by Owings (2009) this definition can vary with every game, every website, and every player. The only thing that all ARGs have in common is the alternate reality gaming motto: this is not a game. Players must interact within the ARG as if it were real. And the success of the game depends on how willing the players are to lose themselves in the game and how interactive they become in it. These games combine narrative elements of a story that are built up and presented to players across a whole range of online and offline media (Owings, 2009). Websites, blogs, SMS messaging, web cams, podcasts, phone calls, emails, letters and live interactions with characters are among the many different ways existing ARGs have utilised to present and show players to enable interaction with particular narrative elements (O'Hara, Grian & Williams, 2008). It is up to the players to combine the different elements together to make a coherent story. There is also a culture in these games whereby clues and problem solving are important components. That is, there are places in the story where specific clues and problems need to be solved to uncover important pieces of information that will progress the story (O'Hara et al., 2008). Having said this, it is very difficult for individuals by themselves to work out all the components and be able to put together the narrative thread by themselves. Having to collaborate with numerous players, players feel more capable, more confident more expressive, more engaged and more connected in their real everyday lives (McGonigal 2004). McGonigal (2004) notes that there are three main areas of ARGs that are beneficial to the user and their self-development. Technological confidence: Players gain skills and experience using a variety of new media and network technologies, players become confident in real-world contexts. Collaboration Skills: Players experience the new kinds of collaboration made possible by mobile and ubiquitous network technologies: e.g., ad-hoc, real-time cooperation. Community: Players feel more connected to and actively engaged with others, both in terms of local community and distributed community, players become a part of "something bigger". The use of these three features of ARG incorporated within online learning creates excitement and a sense of communal presence. These features differ to scenario-based learning where the student participates at a stand-alone level and self-paced learning. Using ARGs for learning is an extension of the work that continues in video gaming. But whereas many universities lack resources for in-house development of a video game, they may possess the skills necessary to create an ARG: storytelling, project management, information structuring, asset creation, and web development (Evans et al, 2010).

Conclusion

As we move forward, the continual growth of information technologies requires that educators engaging in distance education look for new methods and theories for designing and delivering effective teaching (Picciano, 2001). As more and more courses and programs move online, it is critical for instructors to understand culture relevant to online course structure expectations (Lee et al., 2012). Figuring out how to make students feel proud about learning a topic, rather than chastised for not knowing about it, is an important area that needs to be solved, and gamification can lead the way (Pappas, 2013). Using Web 2.0 technologies to create fun learning activities incorporating game mechanics will not only encourage learning but engage students with learning materials in a positive way. This can be accomplished by giving students' instant self-gratification by unlocking more difficult topics (Pappas, 2013), incorporate scenario-based e-learning to connect real life responsibilities with the curriculum being taught, adapting ARG techniques to help keep students engaged and collaborate with materials as they would any other game played and creating an environment that students are experiencing optimal flow and therefore deep-thinking and problem solving with their material is accomplished. As evidence has shown, students engage, collaborate, participate, and experience new ideas and technology because of the use of gamification. Including these game-based thinking approaches in online teaching at the university level will help achieve these goals for next generation of students.

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A window into lecturers' conversations: With whom are they speaking about technology and why does it matter?

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With the rapid rise in interest in open and online education and flexible learning initiatives across the higher education sector, senior administrators are establishing strategies and policies concerning technology-enabled learning. However, technology adoption and integration with pedagogical practice is complex and multi-dimensional with the socio-cultural nuances that impact acceptance often remaining undetected. Reporting on a subset of results from a larger investigation of factors influencing lecturers' technology adoption, in this paper the author reveals how the relational ties and technology-related conversations amongst lecturers stimulate the exchange of ideas. Understanding how lecturers learn about new technologies can help higher education leaders to provide the support mechanisms necessary to foster further knowledge sharing and eventual technology adoption by educators.

Keywords: flexible learning, social networks, higher education, technology adoption

Introduction

Learning management systems (LMS), such as Blackboard, Moodle, and Desire2Learn, are now considered to be a staple technology in the higher education sector. The LMS has essentially transitioned from being an optional innovative technology for extending learning activities outside of the brick and mortar classroom (Hagel, Brown, & Davidson, 2010) to a globally-recognized and required learning application. An LMS today offers a suite of online tools for course organization, communication, and assessment (Siekmann, 1998) that can be used to support the implemented learning activities. With such a range of tools, the LMS "facilitates instructors' management of the course and gives students access to all of their course components in one location" (Kabata, Wiebe, & Chao, 2005, p. 239). While many lecturers use the LMS for disseminating information to their students (Arnold, 2007), others take advantage of its collaborative communication tools for engaging students in discussion outside of the traditional classroom (Cho & Carey, 2001; Levy, 2010). The rise of massive open online courses (MOOCs) in the global education market has placed pressure on the more traditional and predominately face-to-face institutions to revisit the overall concept of flexible learning (Conole, 2010). Furthermore, the uptake of MOOCs by some elite institutions has effectively shifted academic and public perception of online education from the sidelines of teaching and learning activity to the mainstream. Hence, higher education leaders have begun to establish core policies and strategic plans integrating flexible and fully online learning. This largely involves institution-wide adoption of the LMS, as a first step for establishing a learning environment that reflects and facilitates flexible access to education. Now that the LMS is more commonplace in higher education, we are seeing the emergence of new technologies in the educational community. This innovation and adoption cycle is similar to that of the LMS in the late 1990s. Understanding the factors that influenced lecturers to use the LMS when it was an optional and innovative technology may help higher education administrators to determine the support structures that can speed up acceptance of new technologies within their institutions (Abrahams, 2010). One such factor for influencing acceptance and adoption derives from the networks formed and conversations held among the teaching staff.

Technology adoption and conversations

According to Rogers' (1995) Diffusion of Innovation model, technology adoption generally follows a bell curve with a small number of individuals, the innovators, beginning to use a technology when it is first introduced followed by a gradual increase in the rate of adoption, with a decline after the majority of individuals in a given community have begun to use it. The lead innovators or early adopters, therefore commonly demonstrate the potential of a new technology and its context in learning and teaching practice for their colleagues (Bates, 2000; Rogers, 1995). Figure 1 shows the Diffusion of Innovation model and the typical rate of adoption in a given community.

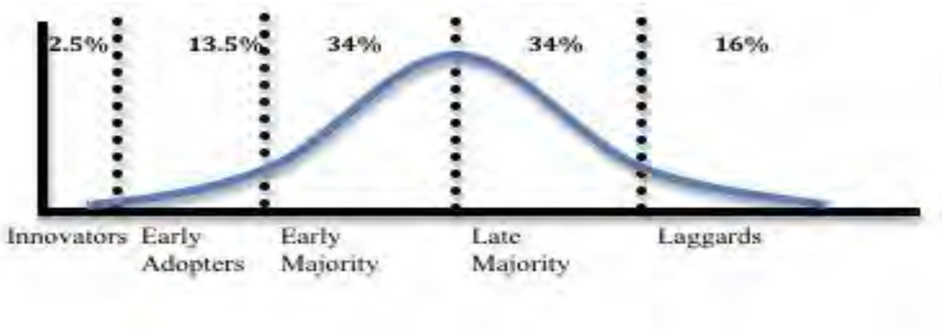

Figure 1. Diffusion of Innovations Model. Adapted from Rogers (1962).

In the higher education context, lecturers who are regarded as the innovators or early adopters can influence technology acceptance by mentoring their colleagues (Roberts, 2008). Furthermore, the conversations amongst lecturers in their professional social networks have been shown to influence teaching practice (Roxa & Martensson, 2009). As Mirriahi, Dawson, and Hoven (2012) posit, lecturers who are more technically advanced, frequently occupy positions of influence in the social networks of their academic departments. These facilitating or *brokering* positions effectively control the informal flow of technology-related information (or conversations) amongst peers in their network. Goffman (1959) refers to the informal conversations amongst individuals that occur privately as *backstage* behaviour that is unrestrictive and allows colleagues to express themselves openly and freely. Connections between colleagues are often based on trust and honesty leading to openness in conversation (Niesz, 2007; Roxå, Mårtensson, & Alveteg, 2011). Therefore, trust and the ability to communicate freely are necessary for lecturers to share their technology-enhanced learning experiences and ideas with others without fear of judgment or disapproval.

Previous studies have suggested that conversations with colleagues who are more technically advanced, or through the establishment of formal mentorship opportunities, can influence an individual lecturers' technology adoption decisions (Mwaura, 2003; Kopcha, 2008; Oncu, Delialioglu, & Brown, 2008). For instance, Mwaura's (2003) technology adoption study revealed that lecturers who adopted educational technology received mentorship and collaborated with colleagues. However, to date there are few studies that explicitly explore the various types of conversations lecturers have concerning technology and its application in the learning and teaching sphere. The case study presented here is situated in social network theory and investigates the technology-related conversations amongst academic staff in a higher education institution. The aim of the study is to interrogate the role that technology-related conversations may have on an individual lecturer's decision to use an educational technology: in this case, the adoption of the LMS. The study explicitly examines the types of conversations teaching staff have with one another in relation to their teaching practice and technology adoption. The application of social network theory in this study provides a rigorous approach to examining and revealing the types of interactions and relationships amongst individuals and the way information is exchanged between them (Haythornthwaite, 1996). As noted by Quatman & Chelladurai (2008), "we come to know and understand the social world by taking the relational components of phenomena into consideration" (p. 341). Everyone has their own network of individuals with whom they interact with and are "tied to one another by invisible bonds which are knitted together into a criss-cross mesh of connections" (Scott, 1998, p. 109). These networks can be complex and interdisciplinary, spanning both formal and informal organisational structures. This network complexity is well demonstrated by Roxå and Mårtensson (2009), who noted that academic staff can have significant networks consisting of conversational partners within and external to their formal academic departments. The authors concluded that academic staff converse with colleagues in their networks for testing ideas or solving pedagogical problems. However, their study explored lecturers' conversations in general, while this study specifically uncovers technology-related conversations in particular. Revealing the types of conversations lecturers have with one another concerning educational technology can help inform senior academic leaders about the support mechanisms required for future technology adoption to occur.

Methods

The author of this paper reports on one particular aspect of a larger investigation about lecturers' technology adoption decisions, namely the types of conversations they have with colleagues in their social networks about technology matters. This qualitative case study is situated within the theoretical construct of social network theory and explores the types of technology-related conversations amongst lecturers in one particular academic discipline - second language teaching and learning. This particular sample population was chosen due to do its long history of integrating technology with pedagogy (Salaberry, 2001). While in an earlier paper, the researcher presented the findings pertaining to the relationship between lecturers' positions in their departmental social networks and the extent of their technology adoption (Mirriahi, Dawson, & Hoven, 2012), in this paper the researcher focuses on revealing how lecturers were initially introduced to the LMS and the sorts of technology-related discussions they continue to have with their colleagues.

Research Setting and Participants

This study was conducted at a research-intensive higher education institution in North America. This particular educational institution had adopted a LMS as an optional technology for academic staff to use to supplement their on-campus instruction from the late 1990s. Despite the considerable length of time since initial adoption of the LMS into the university learning and teaching setting, with the approach reflecting a transmission-style pedagogy, incorporation of the richness and range of complexity of the LMS functionality was rather limited. More simply put – the adoption of the LMS was centered on the upload and dissemination of course content such as readings and lecture notes. Furthermore, senior administration of the educational institution had begun to discuss strategies for expanding flexible and blended learning opportunities that leverage the affordances that technologies bring for student engagement through collaboration and communication tools (Cho & Carey, 2001; Levy, 2010). Hence, understanding the factors that have previously affected lecturers' adoption of the more transmissive-style tools within the LMS, could help drive strategies for future adoption of more socio-constructive technologies.

Through purposive sampling, all lecturers who taught in the disciplinary area of second language teaching in the 2011 academic year at this educational institution were invited to participate in the study. Twenty-three lecturers across three academic departments chose to participate in the study. The voluntary sample represented lecturers who incorporated a range of technologies in their teaching and who had varying levels of teaching experience.

Data Collection and Analysis

A qualitative approach was employed in order to conduct an in-depth and rich (Eisenhardt, 1989) exploration of lecturers' social networks and technology-related conversations. The data was collected through semi-structured interviews. The use of interviews as a data collection method provides participants with the opportunity to express and elaborate on their personal views concerning a situation (Cohen, Manion, & Morrison, 2007). In this case, semi-structured interviews rather than open-ended or completely structured interviews were appropriate for the study as the topic-initiating questions were derived from the research purpose, which therefore allows, for follow-up questions that can elicit more detailed information as required (Gay & Airasian, 2003). All interviews were audio recorded and the transcripts were sent to the participants for their review in order to ensure the transcription of the recoding accurately reflected the interviewees' intent (Carlson, 2010). Prior to the interviews, participants completed a pre-interview questionnaire to provide some background information concerning their adoption of the LMS and conversations with their colleagues, to help guide the interview questions. The final question asked the participants to indicate with whom in their academic department they spoke about technology. This information was used to determine the extent of the individual's social network (or conversational partners) within their department. A roster of names of the individual participant's colleagues was provided, in order to "lessen the likelihood that respondents will overlook certain of their relationships" (Stork & Richards, 1992, p. 205). Since there was limited information regarding their colleagues external to their academic department, the data collected to inform the researchers about their social network was focused only on their internal conversational partners. The interviews, however, provided the data on the types of conversations they had with colleagues external to their respective academic department.

The interviews yielded copious amounts of textual data that was coded and categorized into manageable thematic clusters, facilitated by qualitative content analysis software, namely Atlas.ti. The codes used in the analysis were derived from the data responsively and subsequently aggregated and tallied (Stake, 1995). Information collected from the pre-interview questionnaires regarding with whom the participants spoke about technology in their departments was imported into the social network analysis software, Gephi. This tool allows for the development and analysis of network diagrams to illustrate participants' social ties with colleagues. Such diagrams, also known as sociograms, help illustrate visually the extent to which each participant engages with colleagues about educational technology. This information, coupled with their interview responses, helped reveal the patterns concerning the types of conversations, if any, they had with colleagues internal and external to their formal academic departments.

Results & Discussion

This research study had two primary foci. First, it sought to determine how lecturers initially heard about the LMS and second, it explored the types of technology-related conversations they continued to have with their colleagues. The purpose of both intents was to discover the potential that conversations amongst academic staff may have on their technology adoption decisions.

Introduction to the LMS

One of the initial guiding questions in the interviews requested the participants to share how they first heard about the LMS at their institution. Figure 2 shows the distribution of answers from the 23 participants.

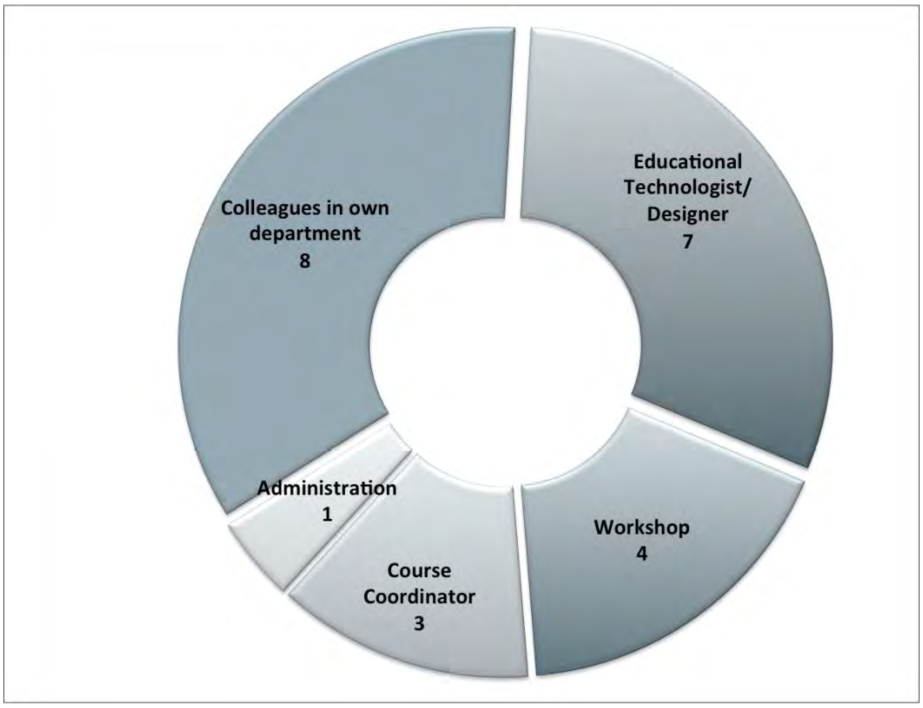

Figure 2: Distribution of how participants were introduced to the LMS

As illustrated in Figure 2, the most common ways that the participants in this study were initially introduced to the LMS was through colleagues in their own department or from an educational technologist or designer linked to their faculty or broader university learning support unit. Other participants heard about the LMS through workshop attendance, course coordinators who indicated which technologies they should use, or by being involved in the administration of the system. The results suggest that the informal conversations amongst colleagues and recommendations from an educational technologist or designer have been influential in the initial adoption of the LMS.

Social Networks

From the information provided in the pre-interview questionnaire, network diagrams or sociograms illustrating with whom the participants conversed about the technology within their department were generated. Figure 3 shows the ties that all participants had with their colleagues in their respective academic departments.

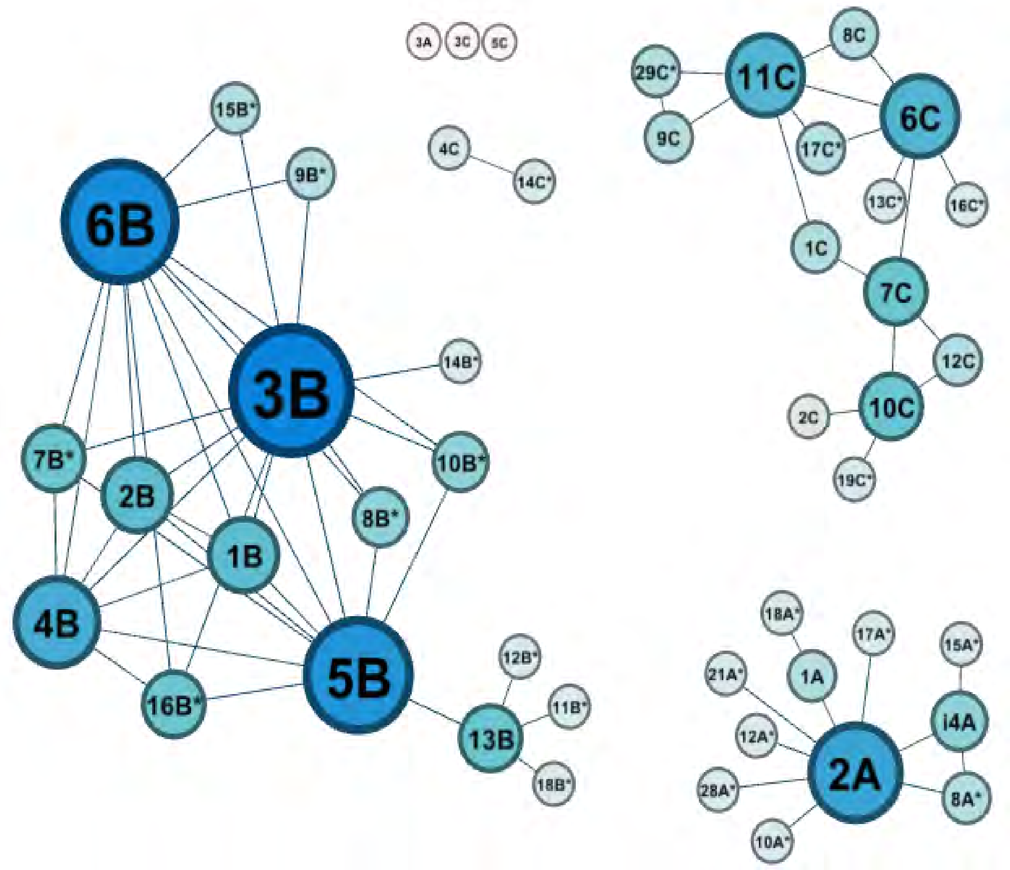

Figure 3: Sociogram of social networks of all participants

The nodes in Figure 3 represent the participants in this study and all colleagues in their departments with whom they indicated that they spoke about educational technology at the time the study took place. Non-identifiable codes are indicated in the centre of each node and an asterisk at the end of the code specifies that the particular individual did not participate in the study. The three clusters of nodes in the figure illustrate that the participants were from three different academic departments. The larger nodes with more saturated colour depict the participants who spoke to a greater number of colleagues than others, or, in other words, had a larger social network. Smaller nodes show that the particular participants had very few individuals in their network, or, in some cases, none at all. The three white nodes at the top of the figure represent this last group. Altogether, the sociogram in Figure 3 reveals that, while many of the participants had conversations with a number of colleagues in their academic departments, some had conversations with a very limited number, if any. The interview data therefore supplements the visual overview, by providing an in-depth exploration of the reasons why some participants may choose to not converse with others as well as the types of conversations the participants had with their colleagues. Furthermore, since the social networks are limited to the participants' ties with their peers in their academic departments, interviews provided information regarding the conversations they may have had with others external to their departments or institutions.

Types of Conversations

During the interviews, the participants were asked to elaborate on the types of technology-related conversations, if any, they had with colleagues in their department, as well as any conversations they had with others externally. Participants were encouraged to reflect on conversations they may have had in the past as well as conversations they continued to have at the time of the interview. They were further prompted to explain whether the conversations affected their decision to use a technology. Figure 4 presents a graph indicating the different types of conversations the participants mentioned having with colleagues internal or external to their academic department.

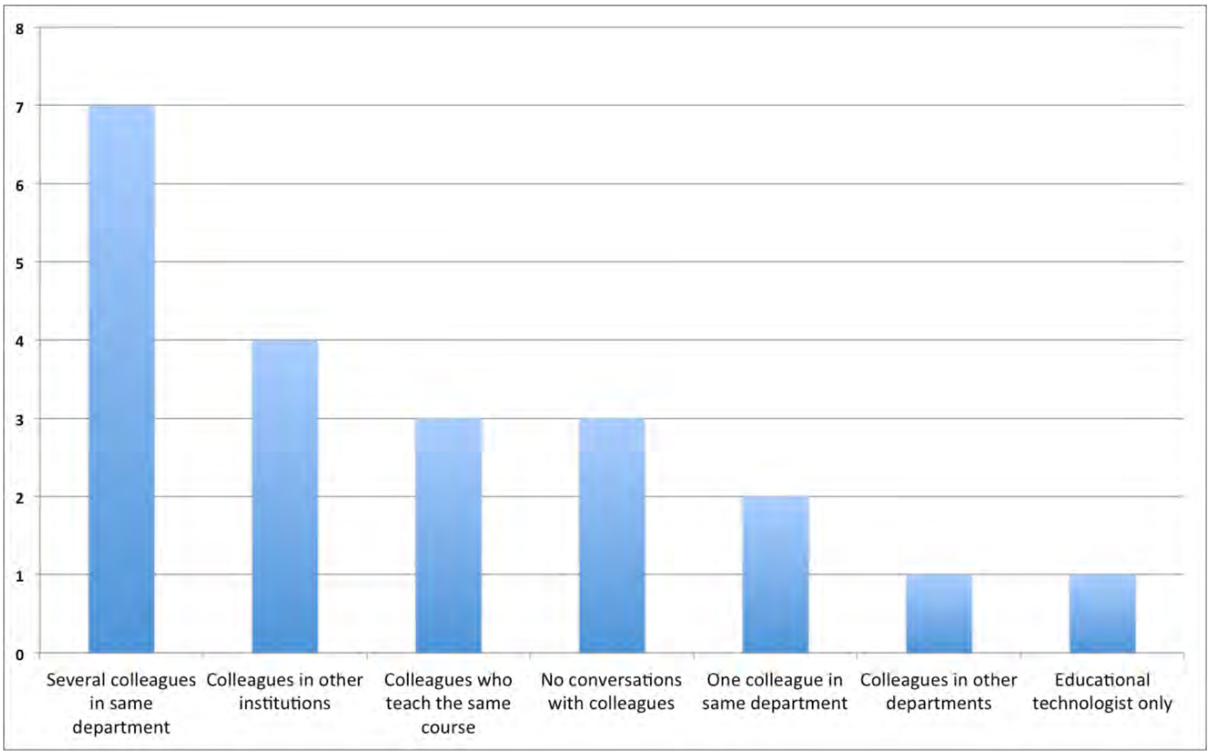

Figure 4: All types of technology-related conversations

As the graph in Figure 4 shows, there is a range in the types of conversations that occur internally and externally to the participants' academic departments. Seven of the participants indicated during their interviews that they had technology-related conversations with several colleagues in their department. This is also demonstrated in the social network analysis illustrated in Figure 3. The sociograms clearly identify seven nodes that were larger than the others and more saturated with colour, indicating the particular lecturers who had conversations with a number of colleagues in their department. Some of the participants noted that such conversations tended to occur informally amongst themselves. For example, one participant commented:

> With my colleagues we share the same office space so if we have time to see each other sometimes we talk about what technologies we can use. [10C]

Likewise, another participant noted that in addition to initially hearing about the LMS from colleagues, informal technology-related discussions continue to occur, although not regularly. As this participant states:

> Some of my colleagues have introduced the LMS to me, and I've been using it ever since. I occasionally discuss Vista with them, not regularly. [13B]

Both of these examples suggest that lecturers informally converse with one another about educational technology. Although the study by Roxå and Mårtensson (2009) was not focused on technology-related conversations specifically, it similarly revealed that university teachers have spontaneous private discussions about pedagogical issues with colleagues within their own academic departments. In addition to the conversations held within the department, out interview data revealed that some participants had conversations with colleagues external to their department. As shown in Figure 4, four participants stated that they had technology-related discussions with colleagues in other institutions and one individual had conversations with colleagues in other departments. One participant who had ties with others externally shared:

> I have plenty of support because I'm part of a trainer network for language teachers…so I meet up with that network maybe twice a year. They are very supportive. [5B]

Similarly, another participant noted:

> I'm not technologically inclined, but I seem to get my expertise and find interesting people outside of the department. [1B]

The participant involved in conversations with colleagues in other departments explained that being involved in a multi-department second language cluster provided opportunities for discussion with those who teach in other departments.

> With a colleague in my department, we co-chair a second language acquisition cluster so through that I do meet with other colleagues who teach languages. [4A]

These three examples illustrate that some lecturers join networks of language teachers external to their academic departments, that they feel would provide the support and opportunity to share ideas about effective technology integration into the curriculum. Although Niesz (2007) does not specifically write about technology-related networks, the three examples above resonate with her argument that teachers engage with networks that are responsive to their passions and interests and provide opportunities for critical dialogue and support. Each of the participants who had joined a network either external to the department or external to the university, had chosen to do so because of the support and expertise available in such teacher networks. However, unlike the participants who conversed with colleagues in networks outside of their department, others limited their conversations to fellow lecturers who were responsible for teaching the same course. During the interviews, three of the seven participants who had indicated on their pre-interview questionnaire that they spoke with a number of colleagues about technology, clarified that their conversations were predominantly with colleagues who teach the same course and occur regularly once a semester. As one participant stated:

> We get together regularly as teachers, we have meetings at the beginning of term and at the end of term and we certainly discuss it [technology] then. [3B]

Regularly meeting with colleagues to share and discuss technology integration into the curriculum relates to some of the responses in Mwaura's (2003) study indicating that some lecturers demonstrate technology use to one another during departmental meetings. The participants that appeared not to have technology-related conversations with their colleagues are represented in Figure 3 as isolated nodes (3A, 3C, 5C). One of these participants elaborated during the interview that the lack of conversational partners was due to an over-reliance on support staff, such as the educational technologist. This is well illustrated in the comment that:

> Because we have here in the department a technician who supports us when we start the course and when we want an online component, he will do the training for us. [3A]

This is consistent with previous studies that revealed that technical staff provided the necessary support and training to increase technology use (Kessler & Plakans, 2008; Mwaura, 2003). The other remaining isolated participants also explained their reasons for not engaging with their colleagues about technology issues. One participant noted:

> I just explore it myself for my own fun, that's about it. [3C]

Similarly, the remaining participant commented:

> My predecessor for the other course is away…and we already have all the tools so we really don't talk about it. [5C]

In addition, two of the participants noted in their interviews that they only speak to one other lecturer in their department. One of these participants commented that this was due to only one other person having the same technical knowledge, as described in the following statement:

> I'm probably the first person to get a PC or actually to get a Mac…although somebody younger like 14C was the one that put me on to the software for films so I mean 14C is at least up on these things as I am. [4C]

In claiming that the choice to use a particular software for language films was due to hearing about it from a fellow lecturer who is equally as knowledgeable, participant 4C reinforces the findings of Oncu et al. (2008) which suggested that meeting with technically-advanced colleagues enables teachers to learn of the potential of new or unfamiliar technologies. Similarly, the other lecturer who had minimal discussions with one other colleague also explained that this was due to being technically inclined and preferring to speak with educational technologists instead. This participant stated:

> I think generally speaking I'm good at learning computer things, software…I like to learn from professionals in the computer area and, so, I don't really do a whole lot with my colleagues. [2C]

This example shows that the participant felt fairly confident about using technology and received training from expert technical staff. This is consistent with the findings of Kessler and Plakans (2008) indicating that highly-confident teachers credited their degree of comfort in using technology to their personal interest and previous attendance at technology-related classes. Therefore, the anecdotes from the participants show that generally those who had limited conversational partners or none at all, considered themselves to be technically advanced and preferred to speak with experts, either more experienced colleagues or educational technologists.

Implications

The findings from this case study yield two revelations that begin to address the factors contributing to lecturers' technology adoption decisions. First, the interview data indicates that the majority of the lecturers participating in this study initially heard about the LMS from colleagues or from an educational technologist. Due to the limited sample size, such conclusions cannot be generalized to the broader population, but they shed light on their potential influence. Senior administrators interested in diffusing a new innovation or technology across their campus may consider investing in educational technologists who can be readily available to share information about the affordances with academic staff. Furthermore, such an investment can continue to have impact as the innovators or early adopters share their experiences with others, introducing them to the new technology and contributing towards further adoption. Second, a combination of the pre-interview questionnaire data concerning the participants' social networks, coupled with their interview responses, shows a trend towards lecturers having technology-related conversations with a number of colleagues both internal and external to their academic department. While some of these conversations occurred regularly on a more formal basis, such as lecturers teaching the same course meeting once or twice a term, others occurred more informally in shared offices or by meeting lecturers who teach elsewhere.

Regardless of whether the conversational ties are between colleagues in the same department or with others externally, the findings from this study, disclose the trend for lecturers conversing with one another about technology and, in some cases, seeking advice from one another. This analysis resonates with the conclusions drawn from previous technology adoption studies reporting that communication amongst academic staff influences technology adoption (Davis, 2005; Mwaura, 2003). It further supports the work of Roxå and Mårtensson (2009) suggesting that the social networks of academic staff do not have departmental boundaries but rather, they establish *conversational partners* with those they can trust and with whom they can discuss pedagogical issues. Higher education leaders, therefore, who are interested in expanding technology-enabled learning at their institutions, may consider devising policies that encourage lecturers to expand their social networks leading to a greater exchange of ideas, strategies, and support. For instance, greater funding for attending professional development or networking events, or opportunities for lecturers to collaborate on course or curriculum development may foster relations that will instigate knowledge sharing and support for technology-enabled learning. Formal mentorship arrangements amongst novice and expert technology users may also advance technology adoption or more sophisticated integration of it in teaching practice across the institution. While this study begins to reveal that exploring the ways that academic staff were initially introduced to previous technologies, namely the LMS, can help inform decisions on technology diffusion in the future, it further contributes to the literature by providing a glimpse of the social networks and the range of conversations and ties that teaching staff have with one another. Determining how lecturers share and receive information about technologies today can help establish future policies and strategies that will gain support and advance technology-enabled learning in higher education.

Next Steps

Since the design of this case study resulted in a small number of participants from a single higher education institution and represented a specific academic discipline, second language teaching, the findings are restrictive to the sample population and cannot be generalized broadly. Expanding the study to other higher education institutions and comprising of participants from a range of disciplinary contexts, would allow for cross-comparison and greater applicability. In addition, while the qualitative study design allowed for an in-depth exploration into the types of conversations occurring amongst lecturers and the reasons for the lack of relational ties for some of the staff, future studies can have a larger scope and sample size with a focus on social network analysis. Investigating the social networks of a larger and more diverse sample population will allow for comparisons and trends to emerge concerning the way information flows and knowledge is transferred amongst academic staff. This could then be used to inform institutional strategies. While this study focused on with whom the lecturers spoke about educational technology, it is worthwhile to extend the study to explore why some types of conversations may have a greater impact on technology adoption. Delving deeper to understand lecturers' perceptions of why they consider certain types of technology-related conversations more valuable than others will provide greater insight into the types of professional relationships and environments conducive for engaging in such discussions. Lastly, the intent of this study was to discover the extent and range of technology-related conversations amongst lecturers occurring face-to-face. The digital connections that academic staff may have with one another were not explored in this study. Future studies could expand the notion of lecturers' social networks to include the electronic ties they have with colleagues through networking sites such as Facebook, LinkedIn, Twitter, and discipline-specific online networks and discussion forums. This may help establish a more accurate depiction of their social network and technology-related conversations, whether in-person or electronically, that spur innovation and enhance technology-enabled learning and teaching. While this study begins to reveal the *backstage behaviors* (Goffman, 1959) of academic staff in relation to their informal conversations about technology, further research in the area of social networks, informal conversations, and technology adoption can advance understanding of the socio-cultural factors underpinning the *diffusion of innovation* (Rogers, 1995) in higher education.

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Mobile learning and professional development: Future building academic work in higher education

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Educators use social media to enrich student learning experiences in the classroom and use personal mobile devices to extend their workplace and productivity across time and space. As learning becomes more mobile, social and informal, the divide between spaces, places and digital devices is merging. Given the disruptive effect learning mobility is having on the foundations of education, knowledge, learning and academic work, this exploratory paper investigates the possible relationship between mobile learning and professional development as potential enablers (or barriers) to academic motivation and engagement in transforming their professional practice. This paper holds the central tenet of 'educators are learners', adopts an 'as-lived' experiences approach which looks at the ways people experience, in this case, mobile learning in natural settings, and is fundamentally concerned with contributing to the body of knowledge on the changing nature of the higher education teacher's academic work in the modern academy. The principal questions guiding this exploratory paper are 'What alternatives are there to current professional development methods that support educators in ways of learning about mobile learning to transform professional practice?' and 'Why are some academics naturally motivated to engage, share and actively participate in alternatives?'

Keywords: mobile learning, professional development, motivation, engagement, academic work.

Introduction

Forces of technology, globalization and competition are transforming higher education (Summers, 2013) . Cook, Pachler and Bachmair (2011, p. 184) caution that educational institutions "are certainly no longer the only site, or even the main site, where learning and knowledge can be accessed and take place". The convergence of mass communication, technological and pedagogical developments has resulted in a range of change pressures on academic work (Garrison, 2011). Educators use social media to enrich student learning experiences in the classroom and use personal mobile devices to extend their workplace and productivity across time and space. As learning becomes more mobile, informal, personalized, contextualized and social, the divide between spaces, places and digital devices is merging (Kearney, Schuck, Burden, & Aubusson, 2012; Stodd, 2013b). For educators, the boundaries are becoming more blurred between formal and informal learning, professional work life and personal life.

This exploratory paper, positioned within the early stages of a PhD study, contributes to the body of knowledge on the changing nature of the higher education teacher's academic work in the modern academy. This will be done by exploring a possible relationship between mobile learning and professional development as potential enablers (or barriers) to academic motivation and engagement in transforming their professional practice. The goal of the developing study is to provide opportunities for educators to reach their full potential and transform professional practice in personally meaningful ways by building a robust sense of their values and beliefs to meet the need for “agile and adaptive academics to be ready for the new world that is now opening” (Debowski, 2012, p. xiv). The study holds the central tenet of ‘educators are learners’ (Cranton, 1996) and adopts an ‘as-lived’ experience approach which looks at the ways educators experience, in this case, mobile learning in a natural setting. To help inform the developing study’s analysis of the real-world problems, a small investigatory study was conducted. Preliminary data[14] was collected from interviews with academics and technology enhanced learning (TEL) academic support staff at one Australian university. Findings from the investigatory study are integrated into the literature review to provide early practical evidence of educators’ as-lived experiences of mobile learning in their professional practice.

A limitation of the preliminary data is that the subjects interviewed were well placed to comment on contemporary approaches to learning and teaching, pedagogy and learning design. However, due to the emergent nature of mobile learning, often comments were elicited from a technology enhanced learning mindset rather than from a ‘purist’ mobile learning perspective.

The exploratory paper is guided by the principal questions to inform the developing PhD study: ‘What alternatives are there to current professional development methods to support educators in ways of learning about mobile learning to transform professional practice?’ and ‘Why are some academics naturally motivated to engage, share and actively participate in alternatives?’ The paper draws on three domains of knowledge in the higher education discourse – mobile learning, professional development and academic work – to investigate and inform how educators learn about their mobile learning professional practice and what they do with the learning.

Mobile Learning

Overview

Kearney et al. (2012) position mobile learning as a relatively new phenomenon where the theoretical basis is currently under development. Traxler’s (2012) view is that there is no generalizable definition of mobile learning and simply considering it as a trajectory from e-Learning to m-Learning is not reliable. Further, Traxler (2009) contends that 12 years of pilots, tests and trials suggest a tacit and pragmatic conceptualisation of mobile learning is needed. This stance is based on the attempts to define mobile learning from multiple, evolving perspectives (Kukulska-Hulme & Pettit, 2009). Some advocates define and conceptualise it in terms of devices and technologies, some in terms of the mobility of learners and the mobility of learning, while others define it in terms of the learners’ experience of learning with mobile devices (Traxler, 2009). JISC’s mobile learning infokit (n.d.) announces it is about the mobility of the learner, where mobile learning allows for contextualisation of learning. The commonality across all viewpoints is that the importance of context cannot be overstated.

When looking at mobile learning in the wider context, it is recognised that mobile, personal and wireless devices represent a paradigm shift in the nature of building knowledge in society, and therefore the nature of learning (both formal and informal). Laurillard (2007) suggests that the mobility of digital technologies creates intriguing opportunities for new forms of learning because they change the nature of the physical relations between teachers, learners, and the objects of learning, positioning learning as “just-in-time, just enough, and just-for-me” (Traxler, 2009, p. 14). At the level of academic work, there is an expectation that educators utilise the capacity of digital technologies to design flexible learning experiences to support diverse groups of learners as they learn how to learn (Oliver, Harper, Wills, Agostinho, & Hedberg, 2008; Phillips, McNaught, & Kennedy, 2011). Beetham and Sharpe (2008) remind educators that there is nothing new about technologies for learning. The networked digital computer and its more recent mobile, personal and wireless counterparts are just the latest outcomes of human ingenuity that can be leveraged to enrich the educational enterprise. Beetham and Sharpe (2008) note that “like previous innovations, they can be assimilated into pedagogical practice without altering the fundamental truths about how people learn” (p. 4). However, as mobile devices become commonplace and tools offer a range of pedagogical potential, little is known about how educators use them in their teaching, learning, work, and leisure (Kukulska-Hulme & Pettit, 2009).

Characteristics of mobile learning

[14] N = 11; academics = 7 (64%); TEL academic support staff = 4 (36%); of the 11 subjects 4 (36%) were classified as holding a management and leadership role in advancing TEL in learning, teaching and research

As mobile learning can be conceived in any variation of learning contexts with its own resultant set of learning opportunities and challenges, the view held in the literature (Kearney et al., 2012; Kukulska-Hulme & Traxler, 2008; Traxler, 2009) is to offer characterisations of mobile learning. Mobile learning is essentially personal, contextual, authentic, collaborative and situated, with this unique cluster of characteristics often positioning mobile learning within informal learning (Kearney et al., 2012; Traxler, 2009). It is these unique characteristics which separate mobile learning from earlier forms of electronic learning (Stanton & Ophoff, 2013). When conceptualizing mobile learning from the perspective of the learners' experience, the emphasis is on ownership, informality, mobility and context (Traxler, 2009). Further, learning that takes place on mobile devices is transforming notions of space, community and discourse (Traxler, 2009). Finding information rather than possessing it or knowing it becomes the defining characteristic of learning generally and of mobile learning especially, and this takes learning back into the connected, networked community (Kearney et al., 2012; Traxler, 2009).

Martin, McGill and Sudweeks (2013) caution that these same characteristics which provide the conditions for learning anywhere and anytime also require the educator to be motivated, self-directed and self-regulated in their approach to professional practice. Further, Martin et al. (2013) emphasise that motivation and engagement both play a significant role in the educator's attitude, energy and drive to work in a mobile conception of society. This in turn inspires and motivates their students to engage in their learning in a climate where the relationship between educators, students, technology and society has implications for the future capacity of communities to imagine and build a world that together they want to live in (Facer, 2011).

Preliminary data collected as part of the investigatory study suggested a level of alignment between the theoretical characterisations of mobile learning - personal, contextual, collaborative, situated and informal – and those uncovered from interviews with academic and academic support staff at one Australian university. For the purposes of data analysis, the interviewees are referred to as 'subjects'.

The research subjects identified a level of mainstream use of mobile technologies in their personal and professional lives from a productivity perspective. Furthermore, interviewees had an inherent sense of personalising the device to meet their individual needs, behaviours, and work and life patterns. They experimented and played with devices in different contexts and found the right blend for their purpose, environment and outcome. There was evidence to indicate a sense of ownership and control of when and how individuals liked to learn, connect, communicate and collaborate with Subject 7 stating "If you need a holiday, turn your phone and devices off". Interviewees commented on the instant, immediate, flexible and highly personal nature of mobile learning, providing opportunities to learn as a community and feel connected across locations and spaces. Less evidence was forthcoming in the ways mobile learning was used to advance learning in their professional practice. Of exception was Subject 9, who saw mobile learning as a nature transition in her academic work, professional learning and discipline context. For her, mobile devices provide opportunities to experiment, connect and engage with students, colleagues and professional networks in a range of learning contexts. Furthermore, Subject 9 demonstrated a level of resilience to some of the unpredictable aspects of integrating technologies into teaching and approached institutional barriers as temporal. Her approach was to adopt an attitude of play, tinkering and experimenting, and to involve her students in this experiential learning environment.

Barriers to mobile learning

At the heart of this paradigm shift of knowledge building in society is the affective and cognitive states of educators. The educator's type and level of incoming pedagogical knowledge and ICT competency, and their associated emotional relationship and identity with technologies, are the critical issues in determining their levels of motivation, confidence, boredom, frustration, alienation and so on (Beetham, 2008; D'Mello & Graesser, 2012; Shute & Zapata-Rivera, 2012; Villar & Alegre, 2007). This state is compounded by the real or perceived pressures of academic-risk taking, workload and time management (Steel, 2004). Academics must feel confident, have a sense of control over their work and consider the learning activities to be meaningful and relevant to assume personal responsibility in advancing their learning mobility professional practice (Martin et al., 2013). Jarache (2013c) sums it up in his analogy that communication in a mobile, socially-networked age is like learning a new language; "it takes time and adults are usually not very good at showing their lack of fluency**.** They don't like to look foolish" (Jarche, 2013c).

Preliminary findings from the investigatory study indicated that the research subjects identified a number of barriers that surfaced across interviews including: ICT competency and the associated emotional states; mechanisms to showcase the value and provide incentives; support and guidance from 'experts' – technical, pedagogical and peers, and a sense of a gap in access to a collaborative, supportive community of practitioners. Time was also considered a barrier from a number of perspectives: time to experiment and make judgments on the value in their teaching context; the time it takes to make a business case, justify the value-quality learning outcome exchange to investing in a change approach, and the resultant layers of institutional control in the decision-making process. There was also a clear sense that there needs to be a whole-of-institution approach to the mindset of mobile learning from top-down, bottom-up and a collaborative team approach.

Subject 10 raised the generational aspect to learning. He classified himself as a luddite, yet through the course of the interview demonstrated his willingness to engage and experiment in the 'right' conditions. These findings indicate the broader study will need to be inclusive of such literature as White, Connaway, Lanclos, Le Cornu and Hood's (2012) study on Digital Visitors and Digital Residents which offers a framework to reassess learners' engagement with digital technologies focusing on group and individual motivations to engage. This study is also of interest as it eliminates the assumed links between generations and technology skill which was a key premise of Prensky's (2001) much lauded and later criticized Digital Natives and Digital Immigrants (Margaryan, Littlejohn, & Vojt, 2011; White & Le Cornu, 2011).

The notion of 'resisters' was also raised. Interviewees provided a pragmatic approach to this phenomenon. The consensus was to focus energy on "those willing and it will trickle down…don't drag people kicking and screaming" (Subject 9). The belief was change agents and early adopters provide opportunities to 'inspire' their peers and discipline, and positively influence perceptions and conceptions. The belief held was to provide platforms showcasing good practice to inspire change and enable individuals to make their own judgment on the level and ways to integrate technologies into their teaching practice. Two further elements relate to this approach. Firstly, interviewees did not feel there was overall a large cohort of 'hard-core resisters'. Secondly, there did seem to be discipline disparity on this. One discipline was accepting of the evolution of technologies as it is was seen as part of the core work of the discipline and academic work, whereas a second discipline held a pack mentality to resistance, 'howling down' guests demonstrating teaching innovations.

Professional Development

Overview

The imaginative use of digital technologies could be transformational for learning and teaching. However, Laurillard (2008) highlights that the problem is that transformation is more about the human and organisational aspects of learning and teaching than it is about the use of technology. Beetham (2008) believes the limiting factor is the availability of skilled educational practitioners with a sense of confidence in integrating digital technologies into their pedagogical practice. The ability of institutional-led professional development to have an impact on digitally enhanced scholarly practice is challenged by the view held by a number of researchers (e.g. Bates, 2000; Boud, 1999; Collis & Moonen, 2001; Laurillard, 2002, as cited in Steel, 2004) who have concluded that many academics are resistant to professional development initiatives (Steel, 2004). The landscape becomes increasingly complex when engagement with digital technologies for learning takes place across a range of institutional and personal contexts (White et al., 2012). For the purpose of this study, professional development refers to a process of engaging in continued learning to enhance knowledge of, skills in, capacity for, and attitudes towards learning and teaching practice, concepts and theories (Reushle, 2005).

To this point, institutional ownership of, and provision for, professional development has been controlled, often mandated, by central management and leadership structures. In many universities, central academic development units have been tasked with leading university-wide education change strategies designed to improve learning and teaching in response to quality assurance requirements and competitive learning and teaching funding (Fraser & Ryan, 2012). Boud and Brew (2012) weigh in on the challenges of professional development to meet the complex and increasing demands of the modern academy, contending that the area of academic professional development remains an under-theorised field of endeavour. Despite the challenges to the contemporary academy, Laurillard (2008), and Barber, Donnelly and Rizvi (2013) agree that the higher education enterprise possesses the ambition; the challenge is for all players to act. Laurillard (2008) believes the pathway to achieve this potential must emanate from the academic community.

Characteristics of professional development

Traditionally, professional development has focused on formal, structured learning activities and/or participation in specified events, taking academics out of their normal context of work and treating aspects of academic work as separate (Boud & Brew, 2012). Academic engagement in their professional practice in the digital age hinges on a fundamental shift in the institution's and educators' perspective of professional development. The key characteristics surfacing in the literature suggest that context, community and dialogue are crucial in reconceptualising professional learning (Beetham, 2008; Jennings, 2013) . Learning needs to be seen as a social process deliberately located within the context of practice, fostering learning-conducive work, and constructed in the act of developing communities of professional practice (Boud & Brew, 2012). Further, Jennings (2013) emphasises learning activities and social collaboration need to be integrated into the context of workflow, offering opportunities to learn, develop and collaborate as part of the educator's work. Jane Hart, a UK-based independent advisor on workplace learning and collaboration supports Boud and Brew's (2012) and Jennings' (2013) research findings. Hart's learning from the workplace crowd-sourced survey[15] identified the five key characteristics of how knowledge workers like to learn at work as: socially, in-the-flow, continuously, immediately and autonomously (Hart, 2013).

Dialogue derived from communities and peers enacts the cycle of motivation. Sharing and contributing to the learning experiences brings about a shift in the locus of control where educators can shape, choose, direct, and take responsibility and ownership for their own learning (Mayes & de Freitas, 2008). In the digitally networked age of learning mobility where work has become distributed, fragmented and decentralized (Stowe, as cited in Jarche, 2013b), Pink (2011) emphasizes that three elements of motivation – autonomy, mastery and purpose – lead to engagement in professional practice. At the heart of high performance professional practice is the individual's true sense of meaning making and identity (Pink, 2011).

Preliminary findings from the investigatory study indicated that the interviewees identified a number of characteristics that served as factors to motivate and engage people in professional development which also surfaced as engagement factors in mobile learning. This supports the authors' belief of learning continuities between mobile learning and professional development. Of significance is that these factors align with current literature and theoretical findings that context, community and dialogue are crucial elements underpinning the characteristics of professional development. Interviewees indicated that motivation and engagement was contingent on collaborative, energetic, communities of learners. The social and informal aspects added to a trusting, connected, sense of belonging and ownership. Furthermore, interviewees stated that activities needed to be contextualized to their own professional (and personal) needs, easily accessible and provide visible, meaningful pathways to desired changing practices in academic work. Interviewees emphasized that professional development is not a 'one-size-fits-all' approach but rather context dependent, community-based and designed for a range of ways to engage staff that offer formal and informal learning opportunities, accessible 'just-for-me' and just-in-time'.

Barriers to professional development

Steel (2004) concluded that many academic staff experience barriers that negate a sense of academic identity and support to integrate technological innovations into teaching practice. The barriers include time constraints, lack of resources, lack of understanding of educational theory and concepts, lack of knowledge of what is technologically possible, and lack of valuing teaching and learning (Steel, 2004).

Further, Steel's (2004) research identified some of the inherent problems in the traditions of professional development as:

> the voluntary nature of these courses means that most academics do not have the incentive or time to attend; courses are targeted at groups so individual needs often go unmet; as different academics are at different points in the change process they are too complex or technical for some and too elementary for others; some staff are uncomfortable exposing their skill levels and participants often focus more on the handling of technology than on the educational aspects; and the skills and knowledge gained in short courses are often soon forgotten because they are not directly incorporated into the individual's practice (Steel, 2004, p. 866).

Preliminary data collected aligns with evidence in the literature relating to the barriers to professional development. Interviewees identified time as a key barrier, where Subject 1 stated "Professional development is the key but in the current climate there are too many pressures to engage in professional development". Interviewees also indicated a sense of limited accessibility and flexibility to resources and support stemming

[15] N= 600; 46 countries; 42% edu-related, 58% non-edu related; organisation size: 61% from organisation with more than 250 people; function: 45% HR /L&D; 65% all other functions; job type: Non-managerial/other: 53%, line managers: 9%; middle: 20%, senior 18%; Age: <30 : 6%, 31-40 : 28%, 41-50 36%, 51-60 : 24%; 60+ : 7%; Sex: Male: 42%; Female : 58% - http://www.c4lpt.co.uk/blog/2013/04/22/company-training-of-little-value/

from the ‘fixed’ nature of professional development events. Mention was also made of the need for events to make explicit the personal value to staff, acting as an incentive to encourage people to engage in professional development. In contrast was Subject 9 who reported an inherent professional curiosity in her academic work and seeks out formal and informal opportunities to learn and engage. This supports Jarche’s (2013c) belief that engagement is not a question of motivating people, but rather understanding why people are naturally motivated to engage and actively participate in a learning community.

Commonality: Mobile learning and professional development

Mobile learning and professional development share common ground in that mobile learning (Traxler, 2009) and professional development (Boud & Brew, 2012) are under-theorised and require a pragmatic (re)conceptualisation. It is this conceptual base and the recognition of characteristics shared across the two domains that impact on academic work which serves as the foundation for this study. The characteristics of context, community and dialogue surface in both mobile learning and professional development as the tipping point to motivation and engagement in ways educators learn how to learn about mobile learning in professional practice and act on their own purposes, values, feelings and meaning-making schemes to gain control over their lives (Mezirow, 2000).

In advancing this study, evidence grounded in the literature signals a reconceptualising of the nomenclature of ‘professional development’. Boud and Brew (2012) emphasise a pragmatic approach where learning is viewed as a social process occurring within the context of practice which, in turn, leads to a fundamental shift in the perspective of academic work as ‘professional learning’.

A potential gap in the research is then how the domains of mobile learning and professional learning can work in union to enable the educator to work, learn, live and achieve their full potential within the changing nature of academic work.

Future building academic work

Debowski (2012) captures the essence of higher education academic work as “one of the most rewarding yet frustrating and challenging roles anyone could undertake. It is complex, dynamic and rapidly evolving to accommodate the expectations of its many stakeholders” (p. 3). When postulating on the many reasons people choose to be academics, Debowski (2012) emphasizes “the most critical is a fundamental love of learning and a desire to share that with others. This is a key driver that attracts us to this rapidly evolving sector” (p. 3).

The pervasive nature of mobile technologies means it is easy for educators to feel overwhelmed by emerging technologies. Kearney et al.’s (2012) research indicates that despite the ubiquity and flexibility of mobile devices and the many opportunities and challenges mobile learning offers education, there has been minimal use of mobile learning approaches. Developments have tended to be more about the design of the tools than of the ensuing learning and teaching (Kearney et al., 2012). Anecdotal evidence collected in the investigatory study support this claim.

Academic work needs to be conceptualised as workplace learning (Boud & Brew, 2012). Jarche (2013e) believes the future of workplace learning is social, informal, cooperative and especially mobile. A distinction is made between cooperation and collaboration. Cooperation is sharing freely without any expectation of direct reciprocation (Jarche, 2013d). As work gets more complex and informal learning takes shape as an essential part of work (Jarche, 2013a), cooperation across previous boundaries of time and space will change the nature of work, from place, to the activity of learning. Workers want to stay connected while on-the-move, maintain social networks, access what they need, wherever they are and believe mobile connections enable productivity. These, Jarche (2013d) claims, are indicators that mobile work is increasing. However, it takes more than mobile technology and social networking tools to support the emerging workforce. Hinchcliffe (as cited in Jarche, 2013e) warns that any use of enabling technology without taking into account how people actually conduct their work, and their preferences for sharing information and interacting with each other, is likely to disappoint. Asking workers how they vision mobile learning will empower them to act cooperatively to change behaviours and work practices.

In addition, social, informal learning has become an important driver for professional practice and workplace learning as it offers new types of professional development opportunities (de Laat & Schreurs, 2013). As workplaces shift from hierarchies to networks and learning agility comes to the forefront, Jarche (2012) advises that organisations can no longer leave learning to their professional development department.

Adopting a wider approach to professional development will optimize the potential for personal and organizational learning (Senge, 1990, as cited in de Laat & Schreurs, 2013). The challenge then for current models of professional development is that however powerful informal learning may be, there is a difficulty in utilising it as mainstream workplace learning. Informal learning activities are mostly implicit, ad hoc, spontaneous, and invisible to others (de Laat & Schreurs, 2013).

Next stage of research

The significance of this study is in its investigation of the phenomena of higher education practitioners teaching and working in an 'always-on' digital learning environment. Fundamentally the authors will take an 'as-lived' experiences approach by asking *how* educators experience mobile learning and the *role* professional development plays now and in the future to support teachers in their academic work.

This paper represents preliminary findings to support a pragmatic reconceptualization of professional learning in a learning mobility environment and suggests potential gains to be leveraged from this union for the future building of academic work. In the next stage the authors will investigate the educators' mindset for mobile learning, that is 'how educators come to the learning?', 'how educators learn?', and 'what educators do with the learning?'(Stodd, 2013c). As digital technologies extend the workplace across time and space, changing work practices result in educators coming to the learning through curiosity, need, by planning or by accident (Stodd, 2013c). Each pathway to how educators come to the learning has its own patterns, motivations and potential barriers. How educators learn about mobile learning can be formal, informal or social providing opportunities for educators to design their own learning (Stodd, 2013c). What educators do with the learning is dependent on their needs. Stodd's (2013c) view is learners apply it straight away, bank it, or use it as a foundation for future learning. This investigative approach supports the literature (Beetham, 2008; Facer, 2011; Stodd, 2013a) and the findings from the preliminary data collection that there cannot be a 'one-size-fits-all' solution to how educators learn, adapt and respond to emerging technologies across the convergence of their professional and personal lives (Facer, 2011; Johnson, Adams Becker, Cummins, Freeman, Ifenhaler & Vardaxis,, 2013; Moretti, 2013). This, in itself, is a reflection of the need for flexibility, creativity and continuity when scaling ways of integrating mobile learning into professional practice. Adopting a wider approach to professional learning may optimize the potential for professional practice as academic work in higher education (Boud & Brew, 2012; de Laat & Schreurs, 2013). Mobile learning supports the design for professional learning that is personalised, situated and authentic (Kukulska-Hulme & Traxler, 2008) suggesting opportunities for new conceptual models to be theorised.

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The current use of ICT by novice female teachers in Saudi primary schools and their perceived training needs

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The overall focus of this study is ICT in primary schools in Saudi Arabia, in particular the use made of ICT by novice female primary school teachers. This represents the first phase of a study that aims to discover whether a tailored training program might help teachers to widen and improve their use of ICT, and thus to improve their students' results. A questionnaire and semi-structured interviews were used in this phase to collect data. The findings revealed that the participants do suffer from a great gap in their knowledge and in even the basic technical and pedagogical skills of using technology in teaching. It was also found that their current use of technology is very low. The reasons behind this could include lack of access to technology, lack of training, and lack of time. The paper also presents some features of the participants' desired training program.

Keywords: Teacher training, primary school, ICT, technology, in-service training.

Introduction

Before designing in-service ICT training for teachers, it was considered necessary to explore their knowledge and skill levels, and how they currently use ICT in their primary school classrooms. The focus of this paper is therefore on teachers who trained in the past five years, and their own descriptions of ways in which they use ICT in their teaching, together with an exploration of factors that influence their practice, and the kind of training that they themselves would prefer. This study will develop the following arguments: 1) There is a lack of ICT training for all primary school teachers in Saudi Arabia; 2) There is a need to design and evaluate ICT training for primary school teachers that meets the needs of teachers and is informed by research and relevant pedagogy.

Despite the efforts made by educational bodies to offer in-service training in using modern technology, most of these courses have not had the desired influence. The reasons for this lack of success are varied. Firstly, the training has been delivered as "one-size fits all", and has not been related to the trainees' specific needs. For example, Edmondson (2003) believes that in the teacher training field, teachers' needs should be identified prior to designing the training package. Aldhahi (2011) confirms that training programs in Saudi Arabia do not meet the quality standards that they should, and do not achieve their objectives because they have not been designed according to teachers' needs. The other factor that decreases the usefulness of the ICT training programs is that the training focuses solely on technological skills. According to Jones (2004), inappropriate training styles that lack pedagogical aspects are likely to be unsuccessful, and cannot guarantee high levels of ICT use by teachers. In contrast however, Preston, Cox & Cox (2000) assert the need for training in some specific ICT skills, especially those needed to solve technical problems and to understand the basic workings of the technology: they provide evidence that the breakdown of technology equipment deters teachers from using ICT.

The Kingdom of Saudi Arabia has shown a great interest in improving the whole educational system, especially in terms of using ICT (Ministry of Economy and Planning, 2010). Although this interest has been translated into many projects and initiatives, most of the efforts and focus have been allocated to the secondary sector, while the primary stage has been largely ignored. More surprisingly, primary teachers are still required to integrate technology into their teaching despite the fact that they have not been prepared for their new roles in such a technology rich environment.

Many of the Saudi studies of teachers' use of technology, that typically focus on intermediate and secondary teachers, reveal a low degree of ICT usage and a lack of training in the field. For example, Alsahli (2012) conducted a study to investigate the educational technology training needs of female geography teachers in Saudi Arabian secondary schools in Jeddah. More specifically, she examined the teachers' training needs in terms of 'Knowledge', 'Usage' and 'Production' of educational technology. She concludes that there is a gap in knowledge and use of technology, which mirrors a lack of training for female geography teachers on both the technical and the pedagogical use of educational technology. The investigation by Alkanani (2012), on the reality of and the barriers to using educational technology in teaching social subjects in the intermediate stage in boys' schools in Al-Qunfoda province, Saudi Arabia, shows that the participants' usage of multimedia technology, Interactive Whiteboard, and distance learning is very low. He also identified the lack of training as one of the most important barriers that inhibit them from using educational technology.

The study by Althubiani (2008), on the reality of contemporary technology usage by Saudi intermediate mathematics teachers, shows that the teachers' use of several technologies including the Internet, Intranet, and interactive video is very low. Alotaibi (2011) conducted a study to determine the extent of the use of educational technology by female science teachers in Haiel city, Saudi Arabia. The findings indicate that the participants rarely use educational technology. The research evidence shows that Saudi teachers from all stages, including secondary teachers, who are the priority for the Ministry of Education (MoE), lack most of the basic skills of using ICT in teaching. The evidence also shows that their use of ICT in their teaching is very low. This would consequently lead to the suggestion that primary teachers, whom the MoE ignores, are especially likely to be in need of more assistance. In particular the importance of opportunities to be trained is highlighted by the research.

The present study argues that there is a crucial need to develop an in-service training program in ICT for primary teachers that uses the most popular theories in the field as well as meeting the teachers' training needs. To gain the most from the proposed program, it will be necessary to implement it and evaluate its effectiveness. The study goes on to propose the design, implementation and evaluation of a training program in ICT skills and related pedagogies. The study is the first to be conducted using this approach in Saudi Arabia in general and in Al Ahsa city in particular. The study may also provide a model for training program designers around the world. The study applies the theory to real practice in order to assess its effectiveness and suitability to the Saudi Arabian educational context.

Research questions

This paper aims to provide answers to the following question: What are the ICT training needs of female novice primary school teachers in Saudi Arabia? This question was broken down into the four sub-questions: What ICT skills do teachers already have and what are the gaps in their skills and knowledge? How do teachers currently use ICT in their classrooms and what factors influence this use? What are teachers' prior ICT training experiences? What are teachers' ICT training preferences?

Population and participants

This study mainly focuses on female primary teachers in Saudi Arabia who have five or less years of teaching experience no matter what stage(s) or subject(s) they teach. At the time of data collection, there were 5754 female teachers working in 1575 girls' primary schools who met the sampling criteria in the six cities in which the data was collected namely Al Ahsa, Dammam, Riyadh, Qassim, Makkah and Jedah. Out of all these teachers 135 participated in the questionnaire and 20 in the interviews.

Data collection and analysis

The questionnaire was distributed by email and post. Approximately 163 questionnaire forms were returned; only 135 were processed and analysed since the rest (n=28) were returned uncompleted with or without a notice of refusal to participate. In total, 20 interviews were conducted: eight in Al Ahasa, four in Dammam, one in Riyadh, two in Qassim, two in Makkah and three in Jeddah.

Since the majority of the questionnaire items were closed questions, they were analysed quantitatively using SPSS software to calculate the frequencies and percentages. However, these numbers were interpreted qualitatively. All the open-ended items from the questionnaire were analysed manually in tables. Similarly, the semi-structured interviews were analysed manually in a template based on the most common themes.

Findings and discussion

1. ICT skills teachers already have and gaps in knowledge

The findings from the questionnaire and the interviews indicated a huge gap in even basic ICT knowledge and skills. This gap is indicated by the low percentages with experience in using Word, PowerPoint, and the Internet although more than half had some experience of using a computer (PC or laptop). Unfortunately, this lack of technical skills is not surprising in the Saudi context. Many researchers have found similar results, such as Aldhahi (2011), Alsahli (2012) and Alkanani (2012).

2. Teachers' current use of technology in the classroom and factors that influence this

The findings from the questionnaire and the interviews highlighted a low level of ICT usage by the participants. There are several possible reasons for this low level of usage including lack of training, lack of time, and/or lack of access to technology. Jones (2004) reports that lack of appropriate training and lack of time for preparation and training are major barriers to ICT integration in education. A low level of use of ICT skills is common in Saudi schools. This finding was confirmed by studies in a variety of Saudi contexts that involved different school stages, different teaching subjects, in different cities and provinces, and as perceived by both teachers and others (Alotaibi, 2011; Alsahli, 2012; Alkanani, 2012). The results also indicated that teachers' current use of technology is teacher-centred. They deal with the technology as a carrier of knowledge and a more interesting method of presenting the lesson. The results suggested an urgent need to train teachers in the pedagogical aspects of the use of ICT as well as the technical ones. Again lack of training in pedagogical aspects of ICT is one of the main barriers reported in both international studies (Jones, 2004; Unal & Ozturk, 2012) and the Saudi literature (Alamri, 2011; Alsahli, 2012).

The factors that influence teachers' use of technology in the classroom could be either disablers or motivators. The most important disablers that were highlighted by the questionnaire and the interviews included lack of access to technology, lack of training in using technology, and lack of time. On the other hand, the most important motivators revealed by the questionnaire and the interviews were teachers' positive attitudes towards technology, perceiving technology as interesting and enjoyable, the belief that technology improves pedagogy and students' attainments, and the perception that technology saves time and effort. These factors are found in the ICT integration literature generally (Cunningham, Kerr, McEune, Smith & Harris, 2003; Unal & Ozturk, 2012; Khan, Hasan & Clement, 2012; Bakr, 2011; Serin, 2011) and the Saudi literature in particular (Oyaid, 2009; Alamri, 2011).

3. Teachers' prior ICT training experiences

The data collected by the questionnaire and the interviews alike showed that the teachers have not experienced a comprehensive training program that aims at both the technical and the pedagogical skills needed to enable the educational use of ICT tools. The separation between the training in technical and pedagogical skills, or the omission of training in the pedagogical aspects of utilising technology in teaching is argued to make the training useless (Preston *et al.*, 2000; Jones, 2004; Unal & Ozturk, 2012). Saudi researchers have also reached the same conclusions (Oyaid, 2009; Bingimlas, 2010).

4. Teachers' ICT training preferences

The participants' preferences regarding future training in ICT were a mixture of technical and pedagogical for the content; blended (face-to-face and online) for the delivery; between one and four weeks for the duration; within school time for the time; collaboratively in small groups for the learning method; and rating themselves regarding their confidence, skills and ability to use educational technology in the classroom for the assessment.

Conclusion

This paper has presented the findings of the first phase of a two-phase study. The focus of the study is to explore the ICT training needs of novice female teachers in Saudi primary schools. The overall plan is to design, pilot and evaluate a training program in ICT and related pedagogies, based on what teachers say they need. The first phase is about investigating the teachers' training needs and preferences in respect of ICT. The findings of this phase indicated that the participants do suffer from a great gap in their knowledge and in the technical and pedagogical skills of using technology in teaching. It was also found that their use of technology currently is very low. This low level of usage could be due to one or more barriers including lack of access to technology, lack of training, and lack of time. However, there are many motivators that encourage teachers to use technology in their teaching including holding positive attitudes: technology is perceived as an enjoyable tool, and technology could improve pedagogy and students' attainments and save teachers' time and effort. The participants were interested in receiving a mixture of technical and pedagogical training and specified some features of their desired training program.

The present study argues that there is a crucial need to develop an in-service training program in ICT for primary teachers that uses the most popular theories in the field as well as meeting the teachers' training needs. Therefore, a program was designed based on training needs discovered in the first phase, which is described in this paper, on research literature describing and discussing ICT training programs and on relevant learning theory. However, the literature review of training needs reveals that ICT training programs are rarely underpinned by learning theories. Social constructivism theory was selected to underpin the design of the program because of the strong relationship between it and the use of ICT in learning (Jonassen, Peck & Wilson, 1999). Kolb's experiential learning cycle also informed the program design as an example of a practical application of constructivism. The study is the first to be conducted using such an approach in Saudi Arabia in general and in Al Ahsa city in particular. The study may also provide a model for training program designers around the world. The study applies theory to practice to assess its effectiveness and suitability for the Saudi Arabian educational context.

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Understanding the use of smart mobile technologies for learning in higher education

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This paper presents a preliminary exploration of the types of smart mobile technologies higher education students have access to and use to support their learning by comparing cohorts from two Australian universities with quite different profiles, the University of Southern Queensland (USQ) and the University of South Australia (UniSA). These results are briefly compared to those obtained in earlier studies in a broad attempt to identify trends in the use of mobile technologies to support learning over time. The results indicate that levels of smart phone ownership are rising rapidly with a corresponding drop in levels of feature phone ownership. Tablet computers such as iPads have emerged since the earlier studies were completed with high levels of adoption by students. Significantly, students are using these smart mobile devices to support their learning.

Keywords: mobile learning, m-learning, smart mobile technologies, Chi-square

Introduction

The increasing processing power, improved accessibility and enhanced applications embedded in emerging mobile technologies has created a challenge for higher education institutions who want to provide students with high quality and sustainable technology-rich environments. Smart mobile technologies, such as tablet computers and smartphones, offer advanced computing abilities as well as access to internet-based resources without the constraints of time or place. The functionality of these devices is continuously enhanced through the inclusion of features from established technologies such as personal digital assistants (PDA), portable media players, GPS navigation, digital cameras and eBook readers (Alley & Gardiner, 2012). This has resulted in devices that enable the provision of ubiquitous learning environments that combine real-world and digital world resources.

Due to the fast-paced changes in mobile technologies, education institutions are cautious about investing resources to provide access to the latest devices. Education institutions are also often hampered by a conservative organisational culture and entrenched processes which impact on their ability to provide wide-scale support for the use of innovative technologies (Maringai, Skourlas & Belsis, 2013). The development of environments that support students who wish to use their own devices, and suited to their needs and contexts, has been proposed as a means to overcome these challenges (Gosper, Malfroy & McKenzie, 2013). This would enable higher education institutions to focus resources on the provision of infrastructure to support ubiquitous access for mobile devices to university systems and infrastructure. Despite the apparent benefits of encouraging the use of mobile devices for learning purposes, few higher education institutions in Australia have implemented platform-independent systems to enable mobile access to university networks.

This research study aims to identify the levels of access students currently have to smart mobile technologies and whether they are currently using these technologies to support their learning. Some preliminary findings from a survey conducted with students at two Australian universities are presented and the implications are briefly considered. The findings from this study will be used to further refine the initial development of a Mobile Learning Evaluation Framework (Murphy & Farley, 2012).

Student access to smart mobile technologies

A study conducted by the research organisation Frost and Sullivan (2012) revealed that 41per cent of Australian residents currently own a smartphone and ownership is expected to increase to 65 per cent by 2017. Approximately, 13 per cent of the population owns tablet computers and ownership is expected to increase to 29 per cent by 2017. Research commissioned by the Australian Communications and Media Authority (2013) also found that smartphones and tablets are not being used as a substitute for other devices already used to access the internet, but rather are being used as an additional device. According to this research study, more than 90 per cent of tablet users also access the internet using a laptop computer and more than 80 per cent access the internet using a desktop computer or smartphone.

Research literature focused around student access to information and communication technologies offers conflicting results. For example, research conducted by Oliver and Whelan (2010) revealed that almost every student owned a mobile device of which many were web enabled. Other highly referenced research conducted by Kennedy, Judd, Churchward, Gray, and Krause (2008) found that although Australian first year university students had widespread access to technology, including mobile devices; these technologies were used primarily for entertainment. It was also found in this research that most students do not have sufficient digital literacy skills to support the use of these technologies for academic purposes. A more recent survey of 10,269 students undertaken by Gosper *et al.*, (2013) shortly after the release of the iPad tablet computer in 2010 revealed that at that time only 5 per cent of students frequently used a tablet computer in their everyday lives. However, this study is silent about use of smartphones for learning-related activities. The types of mobile technologies and rates of ownership have changed rapidly since these studies were conducted, with smart phones replacing the use of web-enabled feature phones. Few studies have been published that have undertaken data collection activities since 2010 to explore the types of technologies owned by students and the manner in which they are using these technologies to support their studies.

Research method

The aim of this research study is to identify the types of mobile technologies that students have access to as well as the extent to which they are using these technologies for informal learning purposes. A quantitative survey was designed and hosted online using the Qualtrics survey platform. Data was collected from two Australian universities; the University of Southern Queensland (USQ), which is primarily an online learning institution, and the University of South Australia (UniSA) which offers the majority of its courses in a face-to-face or blended mode. Neither institution is currently providing learning content designed for mobile technologies at an institutional level.

Course examiners from 17 online courses at USQ were asked to email a survey invitation to their students from April to May 2013. Students at UniSA were requested to complete the survey prior to attending focus groups about their perceptions of mobile learning during the last week in May 2013. The UniSA students completed a paper-based version of the survey. These students were recruited to the focus groups by email invitations sent out by lecturers to their students in the two weeks prior to the focus groups. The data file was compiled in SPSS for Microsoft Windows version 19.0. The results from the two groups of students were compared using the Chi-square statistic. Further data collection is still underway and only preliminary results from questions that relate to student ownership of technologies and use of these technologies for learning will be presented in this paper. A total of 48 completed responses to the online survey were obtained from USQ students and 21 were received from UniSA students participating in the focus groups.

Findings

Participants were provided with a list of technologies and asked to describe their access to various technology types. Three response categories were available: “I own these technologies”, “I use these technologies (but do not own them)” and “I don’t own or have access to these technologies”. For the option smartphone, a note was added to indicate that this category includes phones such as iPhones, Android devices or Blackberry phones. Figure 1 provides information on student ownership of technologies for each of the institutions where data was collected.

Despite the differences between the two institutions, including location and anticipated student demographics, the adoption profile of mobile technologies is remarkably similar between the two groups. Smartphone ownership in both cohorts of students is nearly on par with laptop ownership, with nearly all students owning or regularly using a smartphone. In comparison to the high proportion of students who owned (96 per cent) feature phones in 2006 (Kennedy *et al.,* 2008), only 25 per cent of USQ students and 28 per cent of UniSA students owned a feature phone. A further 4 per cent of USQ students used one without owning it. Smartphones have therefore rapidly replacing feature phones and nearly all students have one.

Considering tablet computers only became available in 2010, one in two students either own a tablet or are regularly using one that they do not own. As illustrated in Figure 1, 40 per cent of USQ students own a tablet and 19 per cent have one at their disposal, compared to 43 per cent of UniSA students who own one and 19 per cent using one. Ownership of tablet computers was still exceeded by ownership of MP3 players, as more than half of students in both cohorts owned these devices. The rapid adoption of tablet computers since 2010, however, suggests that ownership of these devices will continue to rise rapidly. Ownership of e-Book readers and netbook computers was less significant.

Further analysis was conducted to explore the adoption pattern of mobile technologies for leaning purposes between the two institutions. A Chi-square test indicated that the types of technologies owned by students were similar between the two groups. Only one significant difference was identified as students from UniSA were significantly more likely to use but not own eBook readers (24 per cent) as compared to students from USQ (4 per cent), X^2 (2, N = 69) = 6.77, p <.05). This is most likely as the UniSA library allows students to borrow Kindle ebook readers, whereas the USQ library does not have such a program.

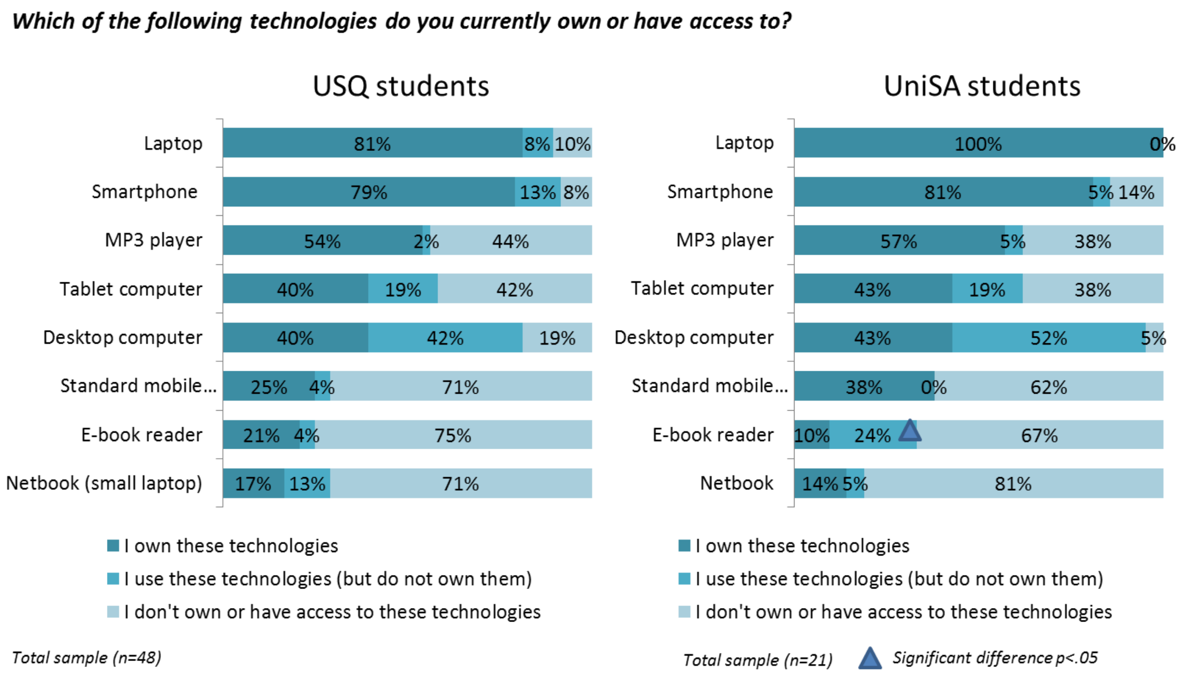

Figure 1: Ownership of technologies by UniSA and USQ students

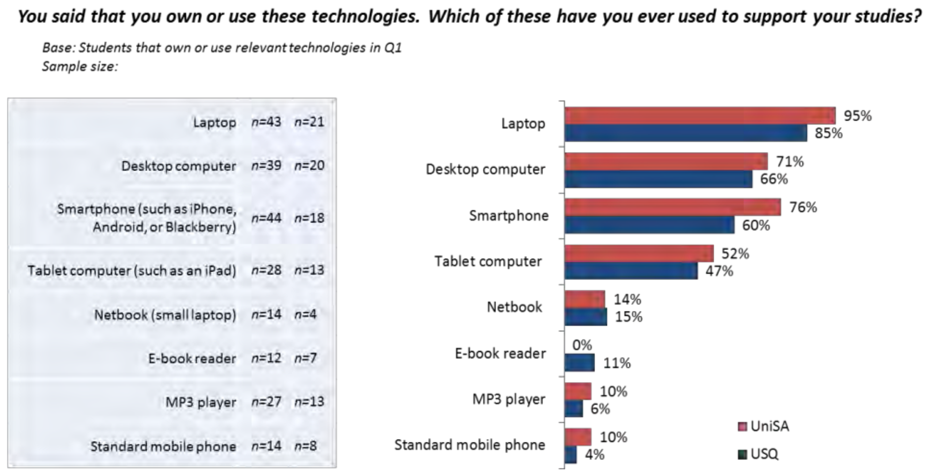

Figure 2: Use of technologies owned or used by UniSA and USQ students for learning purposes

We were particularly interested in understanding whether students who owned or used smart mobile technologies were using them to support their learning activities. Participants who indicated that they owned or had use of these technologies were asked if they used these technologies to support their studies. As illustrated in Figure 2, a large proportion of participants who owned or had access to tablet computers and smartphones used these devices for study purposes. Of the students from UniSA who owned or used a smartphone, 76 per cent reported that they used these technologies to support their studies, as did 60 per cent of students from USQ. The use of tablet computers for study purposes was slightly less, with 52 per cent of UniSA students using their tablets for learning in comparison to 47 per cent from USQ. No significant differences were found between the two groups.

Conclusion

Mobile devices and ubiquitous connectivity potentially allow students to access course materials and activities through the creation of hybrid virtual and real-world resources and social spaces. Higher education institutions are reluctant to provide the support needed to enable access to university systems for students' mobile devices due to the rapid turnover of models and types of technologies. Even so, studies at two Australian universities have shown that students' ownership of smart mobile devices is increasing rapidly. Rates of smart phone ownership are particularly significant given their relatively recent emergence onto the mobile phone market. Unsurprisingly, levels of ownership of feature phones are correspondingly declining. Most notably, students are using their devices to support their learning, especially their smart phones and tablets (including iPads and Android tablets).

Though this data is compelling, studies need to be conducted at a larger number of Australian universities to determine whether or not these results are generally indicative of wider trends in smart mobile device ownership and use to support learning among Australian higher education students. The authors conducting such a study at the Australian National University during August 2013 and are currently compiling the results. Additionally, similar studies are underway among higher education students in Malaysia, Thailand, China, Vietnam, Saudi Arabia and Albania to determine if these results reflect global trends. The data will also be used to inform the development of a Mobile Learning Evaluation Framework to try and address issues around the sustainability of mobile learning initiatives in Australian higher education institutions. A thorough understanding of how students are currently using their own devices to support their learning will enable the developing of more sustainable mobile learning initiatives.

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Enablers and Barriers to Academic's Acceptance of Technology: Can "Individual Differences" Make a Difference?

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With the advances in technology the higher education sector is rapidly evolving. While some researchers are predicting the University of the Future to be more virtual, many academics at the coal face are still struggling to embrace emerging technologies. This paper reports the first stage of a project aimed at identifying the enablers and barriers for adopting new technology among Australian Higher Education academics. In this pilot study, academics who have integrated Tablet PCs in their teaching were surveyed. For a richer understanding of the enablers and barriers of technology uptake, focus groups will follow. The next stages of this research will be a wider survey open to all academics across universities. The ultimate goal of this project is to generate recommendations for universities in better managing the technological change.

Keywords: technology acceptance, academics, individual differences

Introduction

The fast-paced evolution of technology is requiring higher education institutions to go through many changes if they are not to be left behind by competitors who are embracing technology at a quicker rate. Some experts controversially (as reported by Williams (2011)) predict that physical universities will soon become extinct and that with the vast amount of information available on the web, students will be able to find the world's best lectures on the web without going to university.

Such predictions have not passed without criticism. Although Australian universities are "scrambling" to get involved with massive open online courses (MOOCs), it is still too early to predict how sustainable MOOCs will be over the long term (Norton, 2012). However, there is little doubt that universities are changing and that this change is happening quicker than expected leaving higher education institutions with many challenges.

One of the biggest challenges facing the higher education industry in the next few years, according to the NMC Horizon Report for Higher Education (Johnson et al., 2013), is that "most academics are not using new technologies for learning and teaching, nor for organizing their own research" (p. 10). There is no doubt universities urgently need to develop strategies to engage their staff in the uptake of new technologies for teaching and learning, or they risk being left behind.

The uptake of technology has been researched for more than a few decades and various models on *technology acceptance* have been developed and have evolved over time. Technology acceptance in academic contexts has also been highly researched – but with most researchers focusing on the end-users: the students. In contrast, acceptance of technology by mid-level users, i.e. academics at university level is not a highly researched area. The limited literature in this area and lack of a widely accepted and used model to engage tertiary teachers in the use of technology in their teaching suggest that there is scope for research on faculty acceptance and use of technology in the higher education sector.

Background

Technology Acceptance Model and its use in the Academic Setting

Most of the research involving technology acceptance is based on the Technology Acceptance Model (TAM), making it the most widely discussed model on technology acceptance so far. TAM was first proposed by Davis (1986) and, since then, has been tested and extended by many researchers. Overall, TAM has proven empirically successful in forecasting about 40% of a system's use (Legris, Ingham, & Collerette, 2003). The core concepts which drive most of this prediction are "perceived usefulness" and "perceived ease of use". Perceived usefulness is referred to as "the degree to which a person believes that using a particular system would enhance his or her job performance", while perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). TAM argues that actual technology usage is determined by intention to use, which in turn, depends on attitude towards technology. Attitude, on the other hand, is jointly determined by perceived ease of use and perceived usefulness (Tang & Chen, 2011).

The original TAM had been extended to TAM2 by Venkatesh & Davis (2000) where additional constructs spanning social influence process (subjective norm, voluntariness, image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, perceived ease of use) were incorporated, which were considered to influence perceived usefulness. Further extension of the model (TAM3) was proposed by Venkatesh & Bala (2008) where constructs based on "anchor" and "adjustment" were added to elaborate perceived ease of use.

TAM and its extensions have been tested and applied in various contexts, the academic setting being only one of them. In an attempt to apply TAM to an academic setting, researchers have added to the original constructs contained in TAM. Some additional factors that seem to have an impact on technology acceptance by academics are: individual differences, such as innovativeness (Kurulgan & Özata, 2010); concern for privacy and security (Flosi, 2008) and peer pressure (Salajan, Welch, Peterson, & Ray, 2011).

The existing literature on TAM and its application on academics is not very rich and there is more scope for research in this area. This project builds on TAM3 and specifically on "individual differences" that may have an impact on the technology acceptance of academics, in particular.

Enablers and Barriers to Technology Adoption by Academics

In addition to the constructs of TAM and its elaborated versions, researchers have also examined other factors regarding technology acceptance by academics. Ranging from individual to social, various factors can impact technology acceptance by academics (Mirriahi, Dawson, & Hoven, 2012). In a case study that investigated teacher beliefs and integration of a learning management system, Steel & Levy (2009) recommended that in the case of technology integration "one size does not fit all" (p. 1021) and that the diversity in teacher's beliefs must be acknowledged. Similar recommendations are provided by Ertmer (2005) when he suggested that teachers' practices are rooted in teachers' pedagogical beliefs and that it is impossible to change teachers' practices if teacher's pedagogical beliefs are overlooked.

These literature conform that the difference in individual beliefs and attitude towards teaching of each academic should be addressed while managing the change associated with integration of technology at a university.

Managing Technology Integration in Higher Education Institutions

Recent researchers have looked into the implementation of innovation strategies in universities. In his PhD dissertation, Schneckenberg (2007) suggests that active faculty involvement in the change process is required for successful integration of technology in higher education. In a later paper, Schneckenberg (2009) recommended university leaders to implement innovation strategies that are tailored to academic's real learning needs and motivation.

In addition, in their study of South African universities, Czerniewicz & Brown (2009) suggest that universities with "supportive, flexible, non-restrictive institutional policies" would provide the most conducive environment for innovation by staff in the classroom (pg. 130). Phillips (2005) looked into the management of change associated with integrating technology in the Australian context and concluded that although institutional factors do have an impact on technology adoption, the main factors are human – and these are the ones that need to be addressed for an effective technological change.

About the Project

This project was initiated from the growing need for an effective technological management program in higher education institutions. Its aim is to identify how human factors such as individual differences of academics have an impact on academics' integration of technology. The outcome of the project will be recommendations to help universities better manage the technological change.

This paper discusses results from a small-scale survey, which is the first stage of this project. This project is an exploratory study consisting of multiple stages.

In this pilot stage, a group of academics who have integrated a Tablet PC in their teaching for more than a year were surveyed to identify certain factors that influenced their use of technology. This survey will be followed up by a focus group which will better clarify the findings from the pilot stage. In the second stage, a larger scale university-wide survey will be conducted to validate the findings from the first stage small-scale survey. This survey will be designed based on the findings from the first stage. Analysis of the findings from the second stage survey will then be the basis for the formulation of recommendations for technology integration in higher education institutions. We hope to eventually extend this investigation to other universities.

Stage 1 Preliminary Findings

The link to an online survey was sent through email invitation to 43 faculty members of the Faculty of Engineering and Industrial Sciences at Swinburne University of Technology who have been implementing tablet technology in their face to face teaching or in the preparation of teaching material. The first invitation was sent out in late May, 2013 and two reminder emails were sent in early and late June. A total of 14 academics responded to the survey.

This number of responses is too small to generalise, but some of the responses are intriguing and call for further investigation. Generalisation may follow from the larger scale survey informed by these initial responses.

The most interesting findings and how they relate to TAM are summarised below:

- "Because it is fun", "because I like it", "because I like using technology" "to better interact with students" are some of the main reasons that academics reported they use the technology for. These can be related to the constructs "computer playfulness", "computer anxiety", "perceived enjoyment" of TAM3 (Venkatesh & Bala, 2008).
- "Peer pressure" and "pressure from authority" were among the least important reasons for teaching with a Tablet PC.
- The biggest barriers to technology uptake were statements, such as "time commitment to learn", and "time commitment to use". Any version of TAM does not directly address time commitment, but it may be a determinant of perceived ease of use.
- Academics were asked how much they believe themselves to be a "motivator". Most of the academics who reported they were high on the scale of motivator also implemented the tablet in their face to face teaching; and the main reason for their tablet use was "to improve their teaching in innovative ways".
- Academics were asked how much they believe themselves to be an "entertainer". The majority of the teachers who scored themselves highly on the entertainer scale also implemented the Tablet PC in their teaching.
- Academics who strongly identified themselves as a "motivator" thought that the most

significant outcome of teachers using technology was “motivated/engaged student” and “high student achievement”. It could be that teachers who are motivators are encouraged to see motivated students and that could be a reason why they like using technology.

Discussion and Future Directions

We acknowledge that by the nature of surveying such a selected group of academics (all have already taken up a tablet PC for face to face teaching and/or related tasks), we can only report on one technology, and on the individual differences of this homogeneous group. It is too early to generalise any of the findings from this small-scale study. More representative conclusion will be drawn once further stages of this project are complete. The preliminary findings from stage one conform to some extent with the literature in the finding that human factors, such as “liking technology” “motivation” etc. may have a positive impact on technology acceptance. However, the findings cannot be generalised and they call for more research into technology acceptance of academics. Factors that could be considered are personal beliefs, values, individual differences such as personality factors, teaching styles, to name just a few. Larger scale surveys of users and non-users of technology need to be done to make a comparison between these groups. A range of educational technologies, including newly emerging trends such as MOOCs, also need to be addressed in future studies. Readers are encouraged to provide feedback regarding how to enrich this project and identify future directions.

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Technology as a creative partner: Unlocking learner potential and learning

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The value of technology in education is still discounted by many academics. In many instances where technology is considered for learning and teaching, it is done without any pedagogical reasoning or within traditional practices. This limits the role that technology could play in enhancing the learning experience and learning. While the intangible aspect of technology such as communication, collaboration, co-creation and sharing have the potential to significantly impact on student learning, the tangible affordances of technology made possible by 3D printers or Arduino cards can also play a critical role in student cognitive and creative development. Using Pedagogy 2.0 as a framework for the redesign of a first year computing course, this paper discusses the findings of how embedded use of mobile social media, Arduino and emerging 3D technologies, impacted on student and student learning within the proposed participatory design-based research (PDBR) approach. The paper reports on the implementation and findings from the first iteration of a two-iteration PDBR cycle.

Keywords: Pedagogy 2.0, heutagogy, mobile social media, participatory design based research

Introduction

Sir Ken Robinson (2001, 2003, 2011) and in his recent TED talk video titled "How to escape education's death valley" arguably perpetuates how the current education system is stifling student creativity and innovation. Robinson (2003) argues the need to radically rethink the curriculum and the fact that education has remained unchanged for decades even when the world learners live in has (Laurillard, 2002). In particular, the change driven by ubiquitous devices and technology in general has redefined how we communicate and interact with each other and our surroundings (Siemens, 2005; Traxler, 2012). The increasing fluidity and ease with which technology is able to adjust or find a place within the life of an individual is perhaps one of its strengths. Not only does it situate itself well, it is able to enhance the worldview and knowledge through connectivity that makes it an undismissable 'add-on' to have.

The affordances of emerging technologies are always pushing the boundaries of what is possible. In this regard, one would imagine that the education sector would be utilising these affordances to maximise the learning and learner experience. This sadly is not the case as the acceptance, use and value of technology in learning and teaching still eludes many practitioners (Laurrillard, 2012). In cases where technology is considered for use with the students, it is still perceived and implemented as a plug-on within traditional teaching practices. This limits the opportunities to leverage off the affordances of the technology considered for learning and teaching (Herrington & Parker, 2013; McLoughlin & Lee, 2008a). According to Mishra & Koehler (2006) the use of technology in learning and teaching is a complex and multifaceted interplay between technology, pedagogy and the content to be taught. As such, for effective use of technology, pedagogy, technology and the teaching context has to be taken into consideration in relation to each other.

In this paper, we report on the preliminary findings from the first iteration of a PDBR approach. The focus of the study was to investigate the potential mobile social media and other emerging technologies such as 3D printing and Arduino programming have to unlock student creativity, increase student engagement in the learning process and to bridge the distinction between theory and practice for enhanced learning. Pedagogy 2.0 (McLoughlin & Lee, 2008b) was used as an overarching framework for the design and facilitation of the course.

Research context

The Computer Technology in Society (CTIS) course is the first paper the students enroll in the computing degree undertake as a part of their study and is delivered over two campuses. Prior to the start of the design of the course in Semester two, 2012, CTIS was taught in a traditional lecture mode where the students attended a one hour lecture and one hour tutorial in a week. The aim of the CTIS course is to introduce past and present technologies to the students and help them build an understanding of the role technology plays in shaping society, and evaluate its impact. This was achieved through a series of lectures. The lectures throughout the semester aimed to explain the role various technologies (past and present) played in shaping human society such as IBM and Holocaust, eWaste and Punched card technology. The students were assessed twice by administering exams at mid semester and at the end of the semester.

Methodology and data collection

In order to investigate the use of mobile social media and emerging technologies such as 3D printing and programmable Arduino cards, a hybrid approach of design-based research (DBR) and participatory action research (PAR) referred to as participatory design based research (PDBR) was deemed appropriate for use in this project. Unlike other research methods, DBR and PAR both provide an opportunity to situate the research within a context where design, practice and theory are explored in relation to each other (Amiel & Reeves, 2008; Argyris & Schön, 1989; Dede, 2004; Herrington, 2012; Kemmis & McTaggart, 2000; Reeves, Herrington, & Oliver, 2005; Wadsworth, 1998). The hybrid approach provides a stronger platform for collaboration between the practitioner and the researcher throughout the study. This collaboration mutually benefits both parties in gaining knowledge on how the design and the implementation behave within the context (Dede, 2004; Wadsworth, 1998; Wang & Hannafin, 2005). A stronger coupling of the two methods helps build rigour and at the same time helps overcome the time it takes to publish a DBR based project (Anderson & Shattuck, 2012; Herrington, McKenney, Reeves, & Oliver, 2007). While DBR and PAR share many 'epistemological, ontological and methodological underpinnings' (Anderson and Shattuck, 2012, p. 4) that cross-fertilises the phases in both approaches, they are however fundamentally different. In DBR, the focus is on designing, implementing and testing a solution over a series of iterations to produce "new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings" (Barab and Squire, 2004, p. 2). PAR is future oriented through shared ownership between the researcher, practitioner and the subjects of the research project in a participatory and collaborative context achieved through rapid prototyping. In proposing the new PDBR approach, the researcher aims to shorten the time taken to publish a DBR project (prolonged due to the series of iterations) by implementing the participatory nature of PAR. This allows a quicker feedback mechanism to understand the future design implications and iterations because the students become an active part of the research. At the same time, a change in practice can only be achieved if the practitioner is provided the support and scaffold needed to implement the design to use in facilitating the course. In this regard, PAR provides a community driven implementation, testing and evaluation environment in close collaboration with the practitioner and the subjects (Narayan, 2012).

The four iterative phases within PDBR approach (figure 1) were used to investigate and implement the use of learning technologies in the CTIS course.

Phase one of the study started late in 2012 where the researcher and the lecturer for the CTIS met to discuss the issues in class with the students with regard to learning and teaching. This formed the basis and a guideline for literature review. Some issues that arose in discussion and through literature review were the design of the course, student engagement and the overall learning and teaching approach that was mostly teacher-centred. CTIS was content heavy and exam driven with minimal student engagement verging on almost passive student participation. The use of technology in this case Mediasite (Lecture Capture) was done without any pedagogical underpinning and as a plug-on to traditional teaching practice. As Reeves (2008) highlights, the strength and at the same time the biggest weakness of technology is its ability to comfortably sit within old and new practices, meaning technology itself is not capable of leading to improved practice.
In phase two of the project, the solution to the problems explored was designed in line with the broad principles of Pedagogy 2.0. The design involved the redesign of the CTIS curriculum from content and exam heavy to a student-centred, collaborative, project-driven and community-driven facilitation and assessment with an end of

semester exam. The student grade was informed by 50 percent formative student project work and 50 percent end of the semester exam.
In phase three, the design was implemented with the first year computing students, a cohort of 125 students, and a small number (16) based on a separate campus in semester 1, 2013 (16 weeks). An overview of the design and implementation was provided to the students as part of PAR. Data was collected using an end of semester project survey, student created artifacts such as student contributions on the community page (blog posts and microblogging), videos and pictures, 3D models and printed artefacts and an end of the year group poster and report. Reflections, feedback and observations on student uptake and use of the solution were also collected on a daily and weekly basis within the community established between the practitioner, researcher and the students. As this is the first iteration of the design, the findings discussed are an outcome of PAR after the first cycle. The design implications for the second cycle are informed by the findings after the first iteration. *In the fourth phase*, where the focus is on design principles and enhanced solution, a set of preliminary design principles are discussed that will inform the design changes of the second iteration.

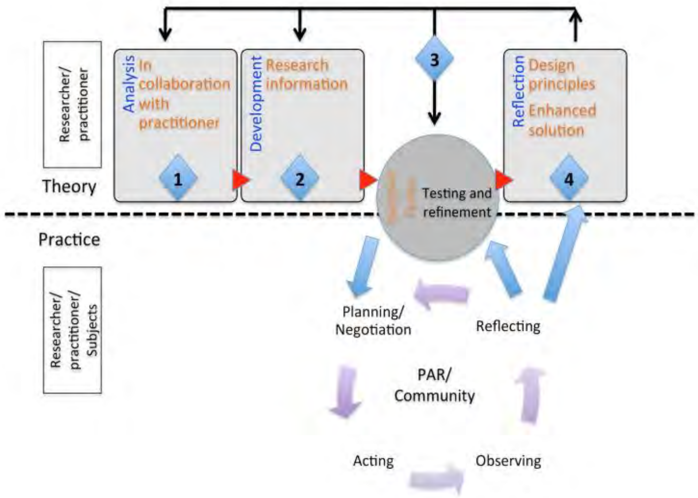

Figure 1 - Participatory design-based research (PDBR)

Theoretical frameworks underpinning this project

For far too long, education has stripped learners of the right to have a voice in the learning process. Over decades, in an attempt to deliver effective education, the learning process has been highly refined and students have been reserved a 'spectator' seat in the classroom. The consequences, even when prevalent in the classrooms today, are still being ignored with the same decades' old practice repeated with a hope of a different outcome.

Pedagogy 2.0

Since the identification of "a second generation, or more personalised, communicative form of the World Wide Web that emphasises active participation, connectivity, collaboration and sharing of knowledge and ideas among users" (McLoughlin & Lee, 2007, p. 665) also called Web 2.0 (O'Reilly, 2005). A number of pedagogies have emerged attempting to harness the affordances of Web 2.0 technologies for use in learning and teaching. For example, connectivism (Siemens, 2005), authentic learning (Lombardi, 2007) and mobile or mlearning (Sharples, 2002), all attempting to enhance student learning by leveraging off the affordances of Web 2.0 tools and technologies.

Pedagogy 2.0 espoused by McLoughlin and Lee (2008a; 2008b) is a framework that stresses pedagogical design of learning and teaching for embedded use of Web 2.0 tools to achieve the learning outcomes required. Where the Web 2.0 tools engage students into learning events that are *personalised* (learner driven, customisation and self-regulatory), *participatory* (learners engage in meaningful discussions, collaborative, communicate and are connected as a community) and *productive* (as an outcome, learners create the content to evidence their learning, collectively advance in knowledge and events or transactions that inspire creativity and innovation) (McLoughlin and Lee, 2008b), this advocates active learner participation through social constructivist and socio-cultural pedagogies (McLoughlin & Lee, 2008b; Vygotsky, 1978, 1986). Pedagogy 2.0 is an open pedagogy and endeavours to encompass the true nature of Web 2.0 for learning and teaching. Given the open nature of Pedagogy 2.0, it forms an overarching umbrella for pedagogies such as connectivism and heutagogy (Blaschke, 2012; Hase & Kenyon, 2000; McLoughlin & Lee, 2008a; Siemens, 2005).

While Pedagogy 2.0 does not explicitly acknowledge the role of mobile devices, it has however been shown that mobile devices or mlearning play an important role in operationalising Web 2.0 tools for learning (Cochrane, 2012; Cochrane & Bateman, 2010; Herrington & Herrington, 2007; Laurillard, 2007). The ubiquitous nature of mobile devices bridges the learning context (formal and informal) and plays a critical role in enabling learner-generated context and content (Cochrane & Bateman, 2010; Narayan, 2012).

Heutagogy, or self-determined learning, is a holistic learner-centred approach to learning and teaching. Where self-determined assumes “that people have the potential to learn continuously and in real time by interacting with their environment, they learn through their lifespan, can be lead to ideas rather than be force fed the wisdom of others, and thereby they enhance their creativity, and re-learn how to learn” (Hase & Kenyon, 2003, p. 3). In the process, the learners engage with and create their own context and content as a part of enhancing and informing their own learning (Blaschke, 2012).

Design and implementation

The design of the solution for CTIS was informed by the overarching Pedagogy 2.0 framework within which, heutagogy and mlearning frameworks formed the guiding principles for learning and teaching.

The concept map (figure 2) outlines the Web 2.0 tools used to support learning and teaching along with student owned devices such as smartphones, tablets and computers. Other computer specific technologies for example, Arduino programming boards and 3D modeling and printing were used to drive student group projects.

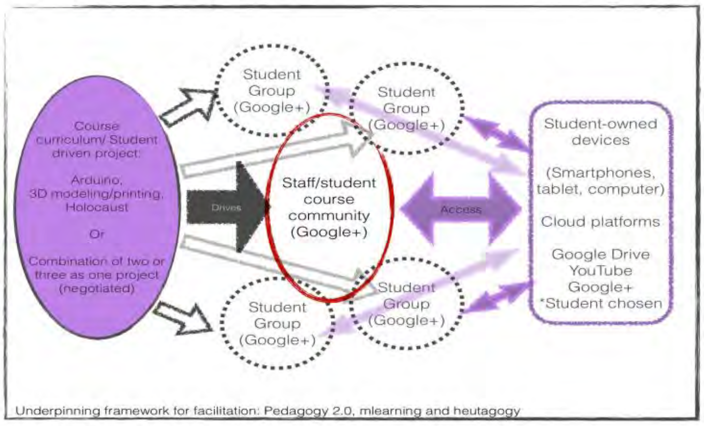

Figure 2 - The design of the learning environment using student owned devices

Google applications such as Google+, YouTube and Drive were heavily integrated in the design of the course. A class community was set up using Google+ that connected all the students in the class and provided a platform for communication, collaboration and sharing ideas. The Google ecology was chosen due to its fluidity with different platforms, such as mobile devices, tablets, laptops and computers. The user experience on any device is almost the same. Google+ apart from the social affordances for learning also provides a ‘Hangout’ function (10 user video conferencing system) over the browser. This further amplifies the opportunity for collaboration and communication and delivers a seamless experience over smartphones and tablets.

A private Google+ class community was set up and all students in the class were invited to join. The students were shown how to use the platform across different platforms. The Hangout feature and its potential for collaboration and communication was also demonstrated to the students. Students were encouraged to use the platform for sharing ideas and resources, and discussing the course content and lecture. The students were also encouraged to activate ‘push notification’ for the class community. The push notification feature sends a message to the user’s mobile device whenever an activity eventuates within the community page; for example, when someone shares a resource or comments on a message. Students were also given an overview of how to create a document in Google Drive and share it with an individual or with a group. An overview of how to upload a video taken using a mobile device to YouTube was also given during the tutorial session.

The Google class community was used as the CTIS student social learning space. A space that students took care of, maintained, created, customised and built together. The teacher and the teaching assistants provided support and guidance within the space when needed by the students and at times posted resources relevant to the topic covered in lectures. The institutional learning management system (Blackboard) was used for course administration purposes, for example, posting class notifications, reminder to students, and course, group and project information along with a forum driven by the lecturer.

Students were asked to create a group project community page for members to use for collaboration and communication purposes and at the same time as a platform for documenting the journey and individual contribution. The students were given four project options (3D printing, Arduino programming, MOOCs (Massive Open Online Courses) and Holocaust documentary) to choose from. The students also had the opportunity to negotiate any other topic of interest with the lecturer. Out of the four project topics, the students could also combine two or three of them into a single project if the group members agreed and wanted to push the boundary of their collective group knowledge. For example, while creating a documentary on Holocaust, the students could also design and print 3D models of the technology used at the time.

Table 1 outlines how the principles of Pedagogy 2.0 were integrated in the design and facilitation of the course.

Table 1: Pedagogical embodiment of pedagogy 2.0 in the design and facilitation of the course

Pedagogy 2.0 elements	Embodiment of Pedagogy 2.0 in the design and learning process
Participation Encourage learner communication and collaboration	Establishment of a class community on Google+. • Sharing ideas and knowledge • Sharing resources • Collaboratively curating resources

Personalisation
Empowering the students by open and flexible facilitation and assessment methods
	Learner driven learning process.
	• Groups establish a Google+ community for project work.
	• Students work with their own device and resources in the project.
	• Students have choice over the topic and 'make-up' of the project and mutual interests within the group members drives the project.
	  o Bring your own device
	  o Create your own project and artefacts

Productivity
Enabling learner-generated content
	Student outcomes in the class community:
	• Discussions
	• Peer support and encouragement
	• Sharing of resources
	• Collaboratively building or curating resources to scaffold learning.
	Group outcomes:
	• Creating and curating resources to build the project.
	• Application of ideas to create project artefacts, such as:
	  o Poster
	  o Meaning and ideas
	  o Digital and other tangible outcomes such as videos, 3D printed models and concepts.

Results

Pre-project survey - Understanding the learner and the devices they won

The pre-project survey was designed to gather data from the students on the type of devices they owned, their age, computing background and if this was their first year at a university. A total of 125 students completed the survey, a return rate of 95% (n=132). From the 125 students who completed the survey, 64% indicated that they were in the 16-20 year old age group, 24% indicated they were in the 20-24 year old age group, while 8% and

4% indicated they were within the 25-30 year old and >30 year old age group respectively. 88% of the students in the CTIS course were 24 years old or younger. Of the 125 students who attended the survey, 64% indicated that this was their first year of study in a university setting. And a further 60% indicated that they did not have any computing experience apart from basic Microsoft Office and operational computer knowledge. All students who completed the survey indicated they had access to a computer, either a laptop or a desktop. Of the 125 students, 40% of them indicated they owned a smartphone (iPhone, Android or a Windows phone) and 18% of the students had access to a tablet device (iPad, Android or a Windows tablet). All students except one had Internet connection at home of which 92% had wireless access.

The result showed that the students had high computer and mobile device uptake. The majority of the students in the course were young, fresh out of college with minimum computing knowledge.

Post-project survey and student projects - Arduino, Holocaust, 3D Printing and MOOCs

A total of 31 groups undertook 30 different projects as part of the CTIS course. One group was disestablished due to student withdrawal from the course. Out of the 30 remaining groups, 12 groups explored 3D modeling and printing. Five groups decided to do a documentary on the role technology played during the Holocaust. Six groups undertook projects using Arduino programming boards. Two groups enrolled in a MOOC to evaluate the learner experience. And five groups combined Arduino, Holocaust or 3D printing into a single project.

In using technologies such as Arduino and 3D printing and in experiencing a MOOC course or revisiting a historic event, the students did not only learn to critique the role technologies play and the impact it has or could have on the society; they were also forward thinking, creative and innovative. The section below discusses some of the 30 projects that show how the design and facilitation of the course not only helped students critique the role of technology but also helped unlock creative thinking, innovation and build confidence for future study. A full list of student projects and output can be accessed here (https://docs.google.com/document/d/1lOMEMmswTe-E3XCmKbRqCupOcpGMhfcasCdyjE_beuY/edit?usp=sharing)

A number of student projects looked at 3D printing as a solution to many everyday issues faced by people and manufacturing industries. For example, a group designed and printed a 3D prosthetic limb (a leg) as a possible solution and argued how the cheap printing costs could revolutionise lives of many people (http://youtu.be/KaNcs5xulIY). While another group pushed the boundary of 3D printing and from their experience of rapid design change and printing reflected how F1 racing cars and competitors could leverage the affordance of 3D printing to customise car design and components for every track (http://youtu.be/01yzMRU2YrQ). Similarly, groups using Arduino programming boards designed smart systems such as a Burglar Alarm that sends data detected to the users smartphone (http://youtu.be/nD0rf58ft0g). Another group designed a Smart Tank through the use of Arduino boards and complex programming scripts that would enable it to navigate any terrain unassisted (http://www.youtube.com/watch?v=uLmw4Ali57s). While the students in this group could not complete the project in time due to problems with sourcing the required parts, they did, however, learn valuable lesson in time management and better planning. As for the MOOC enthusiasts and groups interested in Holocaust, it was interesting to observe how these students used technology to support their process of gathering data, communication, collaboration and reflection. The MOOC group critically reflected on their experience in a MOOC course using Hangout (http://youtu.be/EF_E89UaFHk). Similarly, this documentary was created by the group investigating Holocaust and the role technology played in the process (http://youtu.be/qScq9mWE1dg) using a mobile device to capture footage and pictures from the museum.

In completing the projects, students did not just investigate the impact past, current and emerging technology has had or could have on the society; they also learnt valuable skills in the process such as programming in doing Arduino projects, 3D modeling and software such as Maya, AutoDesk and Google Sketchup and effective use of mobile devices and social media for learning. Important life-long skills such as collaboration, communication, co-creation, time management and digital literacies were learned through active participation within the class community and group work.

Post-project survey, Google+ and student-owned devices in the process

Class community

The institutional learning management system, Blackboard (BB) gave the students enrolled in the CTIS automatic access to resources and content. The course lecturer primarily ran the discussion forums on BB and it was emphasised on multiple occasions during lectures how important it was for the students to participate in the forum, ask questions and comment. On the other hand, the Google+ Class community page was set up by the teaching staff but left up to the students to drive, with the lecturer and the teaching assistants only engaging when addressed directly by the students for help. In spite of the apparent disparity of teacher presence in the Google+ Community, student engagement in this space was superior when compared to the BB course page. At a basic level, only 7% of the students invested time in updating their profile on BB with a picture or a brief introduction compared to the Google+ community, where 66% of the students elected to upload a picture of themself or an avatar and updated their biography. The discussion forum on BB attracted 208 responses while the Google+ community received response in excess of a 1000 student contribution. In the post-project survey, 41% of the students agreed that the Google+ Class community provided an effective platform for deeper learning in collaboration with the peers and the lecturer. Presumably, the high participation rate and student perception that Google+ was a better learning platform are because of the pedagogical integration of Google+ and increased student ownership in the learning process.

Fifty-four students completed the post-project survey, of which 9% of the students agreed that the BB course was the best solution; while 35% of the students agreed that a combination of both platform (Google+ community and BB) provided a better setup. The almost even distribution of student preference between Google+ community and a combination of BB and Google+ perhaps outlines that the students appreciated a space with stronger teacher presence (BB course) where the teacher took a more active role in leading the discussions. 81% of the students in the post-project survey strongly agreed that the facilitation of the course, the learning opportunities and tools used helped build their confidence, knowledge of technologies and other computing skills.

At the end of the semester, students in the class community discussed if they will have access to the community created and whether they could continue using it for learning purposes for the semester to come. This reflected the value and learning experience of collaborative and social learning that helped students learn. It was decided in negotiation with the students that the community will be available and other staff from the faculty who are interested would join to support student discussion and learning.

Group work

The use of Google+ and other Google applications such as Google Drive and YouTube played an important role in enabling a platform from which students could build upon their ideas, coordinate events, share, collaborate and communicate. The availability of the Google+ mobile application for many students meant time or location was no longer a barrier for engaging with group members. The convenience factor enabled by the affordances of mobile devices and social media such as ubiquitousness, social connectedness, the ability to operate across different platforms (desktop, laptop, or a mobile device) and in learner-driven contexts (formal and informal learning spaces) enabled a high student engagement within the group. In the post-project survey, 84% (n=54) of the students either strongly agreed or agreed with the statement “I found the use of Google+ community for managing, communicating and collaborating with my group members on the project, useful.” And 77% of the 52 students who attended this question wanted to see similar use of the tools in other courses.

Discussion

The design of the learning space using contemporary Web 2.0 tools and learner-owned devices in the CTIS course gave students flexibility, choice and ability to brainstorm, design, negotiate and co-create resources to grow and learn as a group (Whitworth, Garnett, & Pearson, 2012). The design and facilitation of the course underpinned by the principles of Pedagogy 2.0 mainly, collaboration, communication, creation and co-creation helped students build confidence and knowledge. A result driven by student interest and having the space and opportunity to be creative in being unbound by the limitations and restrictions normally observed in a university course. In this first year paper, many students enrolling had no prior experience or knowledge of computing. In the redesigned CTIS course, students were able to experiment with ideas and in the process not only discovered their own potential within the discipline but also many attributes of computing that they could pursue during the three year program.

Unlike before, where the students only got to hear and read past events and evaluate the role and impact of technology in the process; the new design and facilitation gave students an opportunity to work on their own ideas, to design, create and then evaluate the impact from their own experience within an authentic context (Herrington, 2009; Herrington & Parker, 2013).

The student project output at the end of the semester was impressive, but it was only made possible through the scaffolding process (McLoughlin & Lee, 2008b). In particular, learner freedom to drive their own learning, having a voice and presence within the group and wider class community, flexibility over space where learning happens and access to support and advice when needed (Hase & Kenyon, 2000). The use of technology such as Google platform and student-owned devices (such as mobile devices, laptops and desktops) provided the students space that they could customise, nurture and co-create to drive their learning (Luckin, 2008; Luckin, et al., 2011; Whitworth, et al., 2012). And the ability provided by the affordances of mobile social on mobile devices allowed the students to transcend the time and geographical barriers enabling learning through learner interaction in different contexts (Pachler, Bachmair, & Cook, 2010; Whitworth, 2008).

In this study, majority of the students (71 of 125) indicated that they owned a smartphone. However, all students in the course had access to a computing device (desktop, laptop or a smart-device). While a smart-mobile device (Android, iPhone or iPad) was observed to have been advantageous in certain instances, however, the cross-platform social media tools (such as Google+, YouTube and Drive) used in this course allowed students flexibility with working on devices they owned and were comfortable with. With bring your own device model; the choice of platforms with operational functionality across-platform and devices is an important design element that has to be considered. In this study, Google Apps such as Google+, Drive and YouTube provided a consistent and stable platform across different student-owned devices.

An important output in DBR is the emergence of the design principles that could be used by others in a similar context with similar problems. While in DBR the design principles are continually refined with every iteration, the principles that guided the design and implementation of the course discussed in this paper included elements such as: (1) pedagogical design for embedded use of technology in the course. This means that the course keeping the problem in mind needs to be redesigned with regard to appropriate pedagogy and technology with a view of active learner participation. (2) The outcomes and expectations are made clear to the students from the beginning and reiterated regularly. (3) Students are provided technological scaffold; not every learner knows how to use the technology or how to use the technology for learning. (4) The teacher needs to model the affordances of the technology that students can leverage to enhance their learning and how. (5) Open pedagogies (student-centred), technologies (ability to operate across-platform) and assessments are used that allow freedom to express creativity without fear of being penalised. (6) Emphasising the need for collaboration with peers in class and within the group. (7) Reconceptualising assessment as 'assessment for learning' with student output and contributions informing the grade. And (8) active teacher presence in student learning spaces to provide support and advice when needed.

Conclusion

The CTIS project has shown a creative approach to the use of learner-owned technology for learning and teaching and for developing critical learner skills through learner empowerment. The learning and projects driven by the use of technologies such as mobile social media, Arduino and 3D, gave the students an opportunity to think differently and to be creative with their ideas. The increased ease for collaboration and communication increased group productivity and created opportunities for student-driven creation of learning resources to scaffold and drive their own ideas from conception to creation. An open approach to course facilitation underpinned by the notions of Pedagogy 2.0 allowed students to explore their potential in different computing streams such as programming, 3D modeling, mobile devices and apps and project management.

Future iterations of CTIS will be informed by the findings from this research to improve course facilitation, student engagement and empowerment. This will give the first year computing students a good understanding of the computing field in general and build skills that will help them through the three years of study.

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Virtual Worlds for learning: done and dusted?

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When Second Life first came to the attention of the mainstream media in 2007, educators recognised the potential of virtual worlds for teaching and learning. They seemed to be the ideal environments to facilitate authentic learning, alleviate the tyranny of distance for students not on campus, and provide an inexpensive and safe environment to teach skills that were too dangerous or expensive to teach in the real world. In spite of all this fanfare, virtual worlds have failed to gain significant traction in higher education. This paper outlines a preliminary investigation into the reasons why virtual worlds have not been adopted for learning and teaching. The reflections of the six authors on this topic were subjected to a thematic analysis with themes arranged under four broad topics. This information informed the development of a survey to be distributed more widely to further explore this phenomenon.

Keywords: virtual worlds, higher education, Second Life

Introduction

In the first decade of the 21st century, virtual worlds were seen as a boon for educators because they provided a diverse and relatively inexpensive environment suitable for authentic learning experiences (Mishra & Foster, 2007), potentially removing the tyranny of distance for students studying away from campus (Ritzema & Harris, 2008), and accommodating a range of learning styles (Bonk & Zhang, 2006). Even after all this fanfare, virtual worlds have failed to live up to their potential; many educators are abandoning virtual worlds and a tour of the most popular of these, Second Life, reveals that many educational builds are deserted (Pfeil, Ang & Zaphiris, 2009). A general search through the literature over the past few years shows a notable decrease in the number of papers published about learning and teaching in virtual worlds. Even ascilite contributions show a decline in the number of papers (full and concise), posters, symposia and workshops: 15 in total in 2010, as compared to 10 each in both 2011 and 2012 (ascilite 2010, 2011 and 2012). Claims made by information technology research and advisory firm, Gartner, support these findings, asserting that virtual worlds are just above the "Trough of Disillusionment" on the Gartner Hype Cycle (Pettey & Van der Muelen, 2012). This paper presents a preliminary investigation as to why educators have abandoned or have failed to adopt virtual worlds for learning and teaching.

Method

The authors of this paper are employed at Australian higher education institutions and work in roles that use virtual worlds (VWs) for education, either as teachers or in roles that support and advance the use of technology in higher education. Two work in the area of health, two in the area of teacher education, one in a central teaching and learning unit and one in the future of information technology in higher education. Over the years, the authors have noted a shift in attitudes towards the use of virtual worlds in education. Once many educators were getting "on the bandwagon" and embracing the affordances of virtual worlds for research, teaching and learning. Now, it appears the hype is over and there is a trend away from the use of virtual worlds. With a view to discovering the reasons behind this shift, the authors wrote about their experiences and perceptions as to why virtual worlds were not widely adopted in learning and teaching across the sector. These reflections were subjected to a thematic analysis. Thematic analysis is a means of encoding qualitative information whereby the encoding is reliant upon an explicit 'code', generally a list of themes. For this exercise, a theme is defined as a pattern discerned in the educator reflections that describes and organises observations of the phenomenon (Boyatzis, 1998), specifically perceptions of why virtual worlds have not been widely adopted into teaching and learning. As the emerging themes were strongly linked to the data itself, the identification of themes can be said to be inductive (as compared to deductive) (Patton, 1990).

Emerging themes

After examination of the data, the following themes emerged under four broad categories: issues relating to - institution, staff, students and virtual world technology. These themes are now discussed in more detail.

1. Issues relating to the institution

Stewart & Davis (2012) suggest that a key factor in the sustainability of any virtual world project is the level of institutional support, which includes policy, ongoing funding, incentives, practical support and a plan for sustainability when individual champions leave the institution. Furthermore, they suggest that these issues should be addressed at the outset in the planning stages of any project. Similar issues were identified by the authors who also broke this broad topic into sub-areas of *institutional policy*, *lack of funding*, *lack of appropriate hardware*, *IT support issues*, *insufficient flexibility of curriculum* and *lack of planning for staff moving on*. Of particular impact to the topic of this study is the number of instances where significant resources have been put into initial development but funding has not been renewed. The result is that these projects are lost. As one respondent noted:

> Monetary requirements/funds need to be an ongoing discussion within institutions. Unfortunately, as this does not happen, many educators have acquired their space due to a grant without anything in place to sustain the space beyond the life of the grant. (R3)

A second area which the authors believe has a strong bearing on the decline of involvement in virtual worlds is the lack of IT support provided. Incompatible firewalls set up by IT administration commonly restrict access to virtual worlds (McDonald, Ryan et al., 2012; Dudeney & Ramsay, 2009). It can be a source of frustration when the onus is on teaching staff to have the knowledge of the technical requirements of the virtual world, in order to communicate these to IT support. A further source of frustration is the practice of limiting access to certain computer labs and locations.

2. Issues relating to staff

The adoption of a new technology is strongly correlated to its perceived usefulness and perceived ease of use (Davis, 1989). Both of these attributes are highly relevant to the adoption of virtual world technologies by educators. *Difficulty of use* and *the steep learning curve* involved are significant factors which elicit a negative response by staff. Other factors identified by the authors include the *lack of teaching support or mentoring*, *ignorance of the potential benefits*, *sensitivity to poor student feedback*, *lack of appropriate technical skills*, *high workload*, *believing misinformation about virtual worlds* (from media, colleagues and so on), *concern over* *inappropriate content*, *discomfort with the environment*, and *non-committal attitudes and behaviors*. Staff are often unwilling to commit to new methods when they are concerned with how their teaching is accepted by the students, particularly when the new methods involve a considerable time commitment. As two respondents commented:

> [Staff] have enthusiastically talked about virtual worlds … and say they can see the potential. However once I try to get them in world they spend very little time there. (R1)

> Negative student feedback is a major factor in favour of maintaining the status quo. 'Will this decrease my scores?' is a likely question that is asked of [*sic*] staff considering virtual worlds in teaching. (R2)

The issue of time commitment also figured heavily in the authors' perceptions.

> High workload is an issue such that educators are unwilling to look into any new technology for learning and teaching. Though they are not especially opposed to the use of virtual worlds, they do cite lack of time as the reason why they can't engage with that particular technology. (R4)

3. Issues relating to students

There is continued discussion on the importance of e-literacy (Bennett et al., 2008) and the extent of the current generations e-bility. The authors identified that many students display a *lack of appropriate technical skills* in a virtual world environment.

> Although students may have experienced the 3D virtual world in games, this does not flow over into a willingness to engage with them for their studies. (R5)

A further difficulty noted is that many students experience real or perceived *technical issues* with some having poor access to the *connectivity*, *bandwidth* and *hardware* required.

4. Issues relating to virtual world technologies

Two particular obstacles inherent in the use of virtual worlds are *lack of scalability,* thus educators with large classes are inherently excluded from using them or users of small areas are in danger of becoming lost in an open world environment, and a *poor user experience*. Users are deterred when access to a virtual world is characterised by a sometimes 'laggy' (slow and jerky) experience and unreliable features such as voice and video.

> Educators cite these kinds of issues related to the stability and reliability of the environment as a reason as to why they couldn't be bothered with virtual worlds. (R4)

Where to from here?

Based on the themes that have emerged from this reflective exercise, the authors are investigating further to determine if their assertions are held more broadly across the sector but also to unearth any other factors that they have overlooked. A short survey has been developed with questions designed to interrogate the themes identified but with space provided for other reasons the authors have not yet identified. Demographic data will also be collected. The survey was designed and deployed in Qualtrics with the link disseminated through the mailing lists and social networks of the authors. Ethics approval was secured to conduct this research. At the time of writing, more than 260 people worldwide had completed the survey and many of the respondents have contacted the authors directly to elaborate on their views. This is obviously a highly topical issue across the sector.

Conclusion

This paper describes a preliminary investigation into the reasons why educators working in higher education have not adopted or not continued the use of virtual worlds for learning and teaching, given the well documented affordances of these environments. Six educators experienced in the use of virtual worlds for learning and teaching, documented their reflections of the perceived barriers to use of virtual worlds. These reflections were subjected to a thematic analysis and a number of themes emerged which could be grouped under four headings: 1) issues relating to the institution; 2) issues relating to staff; 3) issues relating to students; and 4) issues relating to virtual world technologies. An analysis of these themes formed the basis of a questionnaire which has been widely deployed through networks and social media to further investigate the reasons why virtual worlds have not been widely adopted for teaching and learning across the higher education sector.

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Distributed Digital Essay: Academia connects with social media

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A key challenge faced by higher education is the evolution of assessment tasks to better suit the participatory and collaborative way in which our students use the web. This paper provides a model for a distributed digital essay that incorporates academic rigour with the peer discourse that has become the norm for digitally literate scholars active in social media. Our model is derived from a community of inquiry approach and prioritises students' engagement with the academic literature in their discipline. The model empowers the students to extend their learning community beyond the boundaries of their particular student cohort into a professional network. Students produce a digital artefact in which they expound their evidence-based knowledge and also demonstrate how they have used social media to test and consolidate their understanding. We provide an example that demonstrates how the distributed digital essay task was integrated into an online, postgraduate unit with an inquiry-based approach to learning.

Keywords: distributed digital essay, assessment, social media, peer feedback, community of learning

Higher education must evolve in order to effectively meet the expectations and skills of a student population that has readily adopted popular social technologies (Kukulska-Hulme, 2012, p.247). "Students already spend much of their free time on the Internet, learning and exchanging new information through various resources, including social networks" (Johnson, Adams Becker, Cummins, Estrada, Freeman,and Ludgate, 2013, p.8). These students belong to a participatory online culture in which collaboration and networking are the norm. There are clearly significant benefits in engaging these skills in their university learning experiences. However this will require a definite shift towards using technologies that connect students to their peers in meaningful and challenging discourse, and a commitment to developing new methods of assessment that constructively align with these dynamic learning processes (Wasson and Vold, 2012, p.255; Biggs, 2003). This paper will provide an example of a new assessment task designed to engage students using the technologies from the participatory online culture that they embrace in their social lives, and it is also focused on supporting students to genuinely participate in the academic discourse of their discipline.

The disconnect: participatory online culture vs traditional LMS and assessment practices

Rovai (2003, p.5) advocates for assessment that "encourages discourse about learning" because collaborative discourse engenders a sense of community which increases student motivation and decreases attrition rates.

Unfortunately, although active peer collaboration and feedback are generally regarded as positive contributors to student learning in higher education, peer discourse has not been comprehensively integrated into online learning environments or into standard assessment practices. Online courses are often structured more traditionally whereby students are required to work independently on the course content and assessment tasks with limited connections with their peers. Furthermore, feedback on assessment tasks is often "controlled by and seen as the responsibility of teachers …. [and] is still generally conceptualised as a transmission process" (Nicol and Macfarlane-Dick, 2006, p.199). This means that students are likely to feel a disconnect between the participatory and collaborative online culture of their social lives, and their relatively sterile online learning environments using the institution's learning management system. This disconnect is reinforced by the teacher-centred approach to assessment which is unlikely to "leverage the online skills learners have already developed independent of academia" (Johnson, Adams Becker, Cummins, Estrada, Freeman,and Ludgate, 2013, p.8). The distributed digital essay is a new assessment task that seeks to address these problems by extending the students' learning community beyond their LMS to include professional and academic peers from their field of study and enabling students to utilise their online networking and collaboration skills to seek feedback from these peers on their learning. Ultimately the students produce an assessment artefact that demonstrates their knowledge and understanding that has been tested by their peers using social media.

Connecting with peers and building disciplinary knowledge

In contrast to most traditional LMS, social networking sites prioritise community and collaboration with peers (Arnold and Paulus, 2010, p.188). These sites have been credited with introducing "social scholarship" and "evolving the ways in which scholarship is accomplished in academia" (Greenhow, Robelia and Hughes, 2009, p.253) Social scholarship is embodied by "openness, conversation, collaboration, access, sharing and transparent revision" (Cohen, 2007, cited in Greenhow et al, 2009, p.253). Students are able to witness and participate in this social scholarship and they can use the networks to seek and provide formative peer feedback. This peer feedback has a key role in establishing a participatory culture of learning and it encourages students to value the process of constructing their knowledge in addition to presenting the final (and traditionally assessable) product (Wasson and Vold, 2012, p.256). Greenhow, Robelia and Hughes (2009, p.247) describe how the "validity of knowledge in Web 2.0 environments is established through peer review." Knowledge is described as "decentralized, accessible, and co-constructed by and among a broad base of users" (Greenhow, Robelia and Hughes, 2009, p.247). This is aligned with the social constructivist theory of learning in which "learners actively construct knowledge within the challenging arenas of their learning environments" (Giridharan, 2012, p.734).

Akyol, Garrison and Ozden (2009, p.78) endorse a social constructivist approach to building online communities of learners and they define learners as "collaborative knowledge builders." Garrison's model facilitates the students' generation of meaning and knowledge that is relative to themselves and their specific learning community (Swan, Garrison and Richardson, 2009). In contrast, the distributed digital essay model requires students to develop their knowledge relative to the existing disciplinary body of knowledge, not just relative to the peers in their learning community. By doing so, learners can contribute to an ongoing disciplinary discourse - progressing the knowledge in their chosen field, not simply increasing their own personal understandings. The distributed digital essay aims to contribute to the evolution of social scholarship for students entering as novices into the academia of their respective disciplines. The distributed digital essay embraces the participatory culture of learning offered by online collaboration and networking, however, it also prioritises the academic rigour of disciplinary research and evidence-based knowledge.

The Distributed Digital Essay in practice

The essential concept of the distributed digital essay is the students' participation in the disciplinary discourse of their field by developing and testing knowledge claims within their academic and professional network of peers. The following model can be applied across a range of disciplinary areas.

This particular example of the distributed digital essay has been integrated into an online, postgraduate unit with an inquiry-based approach to learning. The students in the unit are expected to extend their foundational knowledge and understanding of child development through reading, reviewing and critiquing research. On completion of their postgraduate program, these students will usually enter working environments in which they may be the only staff member with a higher education background. The personal online network that students build in this unit can continue to provide them with access to their academic and professional peers, thus enabling them to continue their participation in the disciplinary discourse of their field as experienced practitioners. Social media provide “the conditions in which knowledge is shared and new knowledge is created or exchanged” (Razmerita, Kirchner and Sudzina, 2009, p.1022).

Task Design and student support

In order to effectively integrate the distributed digital essay into a course, the teacher needs to consider the overall learning processes and the schedule of assessment. This involves linking the task directly with the learning outcomes of the course, planning the staging of the task across the length of the course, developing support resources, and, where possible, relating the task to other assessment items.

Depending on the students’ familiarity and willingness to engage with social media, they may require some explicit explanations of the rationale for including social media in an academic course. It is important that the students recognise the value of the task so that they embrace it as a key learning tool. It can be useful to provide an online guide and even a sample essay that students can refer to if they are feeling unsure about the requirements and expectations of the task. In our example, we provided an explanatory video, an online guide and a sample essay for students (Figure 1). It would be useful to inform students how much flexibility they have in the format of their final digital artefact. A drawback of providing a sample is that students tend to restrict themselves to re-producing their version of the sample and this can limit the students’ creativity. Providing a range of different options may mitigate this problem. The task design can be flexible and the format of the digital artefact can be chosen to best suit the discipline, the specific learning outcomes and the student demographic.

In our example, the artefact was a written text in which the students demonstrated their understanding and analysis of disciplinary research; and, how their ideas and ways of thinking about the literature had been impacted by their participation in social media. Students were encouraged to commence their online networking at the start of the course and then progressively build up their connections and participation throughout the session, culminating in the production of the digital artefact. Some students may lack the confidence to participate actively in an online community that includes academics and professionals. In this case, their own student cohort can be a source of encouragement and support. It may be helpful to include a discussion forum in the students’ LMS where they can express any concerns they have about their contributions to the broader online community which may at times appear intimidating.

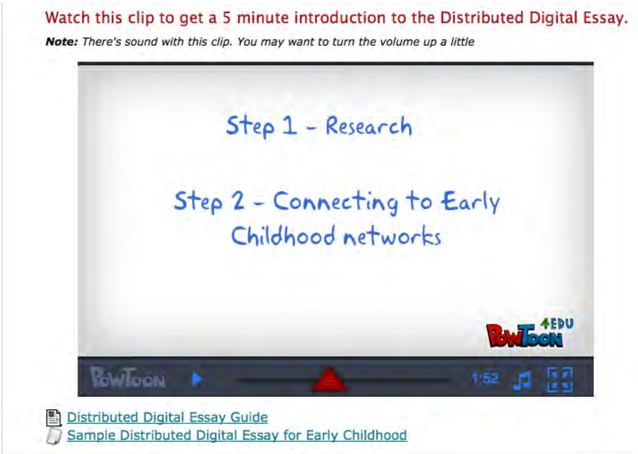

Figure 1: Screenshot from the LMS – online support resources for students

The Learning Processes

The process of academic inquiry

Based on their research of disciplinary literature using standard academic databases and journals, students start developing their understanding of the key concepts that relate to their area of interest. The students will formulate knowledge claims which are supported by robust, academic evidence and they will take these knowledge claims to discuss with their peers in the social media. This academic inquiry is an ongoing process throughout the course.

Getting connected and extending the online learning environment

At the start of the course, students create accounts on social media sites and explore posts that are relevant to their area of interest. They are encouraged to discover what academics, professionals and peers in other organizations are talking about, relate this to their academic inquiry where possible, and then connect with the relevant individuals and organisations. Ideally, teachers can provide a role model of an academic with a digital identity that is connected and participatory. If departments have their own Facebook page or blog, this can help students to start their networking with some familiar and relevant connections.

Engaging with the online community and collating findings using Storify

Having commenced their academic research and dabbled with social media, students are ready to navigate their way through the digital discourse (which can be noisy at times) to find and engage with voices to support and challenge their ideas and knowledge claims. Students need to initiate and/or find relevant conversations, tweets, posts, videos etc. which will provide a means for them to participate and contribute to the online community. Setting up a live Twitter feed relevant to the disciplinary area in the LMS can provide a helpful stimulus for students.

In order to adequately test their ideas and extend their understanding of the literature, students need to become active participants in their online community. This may be daunting for students who are inexperienced with social media, but the skills they acquire will enable them to stay connected with their professional, online community beyond their university studies. It's important to encourage students to go beyond simply lurking and observing online. Although Veletsianos and Navarrete (2012) argue that "lurking may be a vital form of participation."

Often another challenge with social media is efficiently collating findings and contributions. The distributed digital essay utilises a tool called Storify to help students to easily collect the social media posts that they find or contribute and integrate these into their distributed digital essay.

Writing the distributed digital essay and sharing it with peers

Having built up a collection of relevant links to social media sites, the students can construct a digital artefact in which the students expound their evidence-based knowledge and also demonstrate how they have used social media to test and consolidate their understanding (Figure 2). Storify enables students to publish their digital essay and distribute the URL throughout their learning community for further comment and feedback.

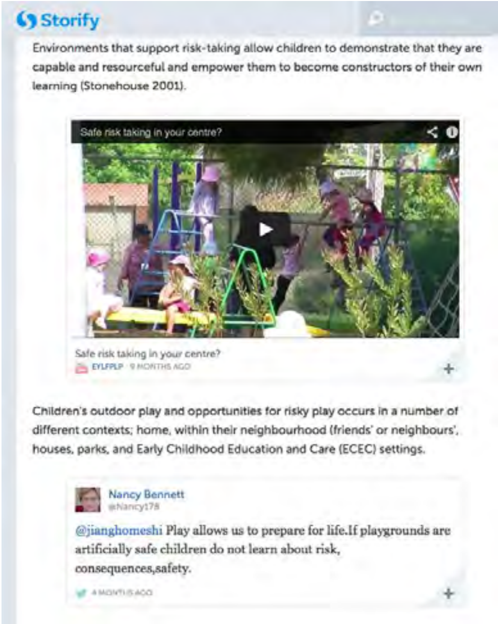

Figure 2: An extract from a sample distributed digital essay

One of the challenges in constructing the distributed digital essay is adjusting the register of the text to combine formal, academic, evidence-based writing with the more relaxed, social media voice. Students may also insert a more personal voice reflecting on what they learnt from their social media interactions. In our example, in addition to producing the digital artefact, students were asked to write a separate reflection explaining how social media had contributed to their thinking about the concepts raised in the academic literature. Interestingly, one student stated in the course evaluation: "… social media challenged my understanding of my chosen topic. Furthermore, it consolidated the knowledge I had gained through academic research by encouraging me to critically appraise..."

The distributed digital essay is an assessment task that creates an opportunity for students to give and receive feedback from peers in an online community that extends beyond the cohort on their LMS. As academic inquirers; students research, explore, analyse, question and formulate ideas in response to the body of knowledge in their discipline. The participatory online community created by social media is an ideal forum to test out these ideas or knowledge claims. Social media extends the inquiry process beyond academia. The connections made by students can be maintained as they become practitioners and continue to actively contribute to the evidence-based, disciplinary knowledge in their field.

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The Learning Ecosystem: A practical, holistic approach to old problems in a new world

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This paper reflects our journey towards the dream of a seamlessly enhanced teaching and learning framework to support our academic excellence through VLEs. While we often seek to move forward and embrace the future of education, it is increasingly important to reflect on the importance of our present, both in terms of a stable base to build onto and as a rich source of lessons to be learnt. We therefore seek move away from repeating the mistakes of our past, taking a broader holistic perspective of the embedding of technology in education. Our model and practices draw on literature to build on analogy of a learning ecosystem, which then informs our first steps in a brave, new "recombinant" form.

Keywords: Learning ecosystem, educational technology, e-learning, recombination, pedagogy, higher education, VLE, evolution

Introduction

This paper reflects the journey which we have embarked upon within Business School X, reaching for the idyll of a seamlessly enhanced teaching and learning framework to support our academic excellence through Virtual Learning Environments (VLEs). While we continually seek to move forward and embrace the future of education, we have increasingly come to reflect on the importance of our present, both in terms of a stable base to build onto, but also, and maybe more importantly, as a rich source of lessons to be learnt.

The School's early exploration of Virtual Learning Environments (VLEs) as tools to support the educational experience began over a decade ago (1992). Since then, this relationship has continued to evolve, and remains an important part of enhancing, extending and reinforcing our teaching and learning, along with developing new innovative and international approaches. Part of a collegiate-structure University, the school now shares a central VLE with other Schools, and both benefits from, and contributes to, a rich culture of pedagogy and educational technology.

However, two years into the most recent VLE upgrade, at the beginning of 2012, it became apparent that though we were still ahead of many of our School contemporaries, age-old problems still remained. The VLE was still perceived institutionally as an isolated element that often replicated previously established tropes, and while pockets of innovation dotted our landscape our use of the system was not fulfilling the promise of our original ambition. Still constrained by older paradigms, we needed to move beyond our baseline use, increase staff uptake and establish an integrated and connected approach, more in line with our academic staff's pedagogic best practice.

At the same time, increasing external pressures were adding further impetus to evolve our educational technology offering. Better support models for larger cohorts of students were needed, while still maintaining a high quality of teaching and personalisation. The extension and integration of other student support services within our support base was required to better extend and enhance our students' employability skills.

Sleepwalking to the future

Despite the ever increasing rate of technology innovation with its vast pedagogic possibilities, wide scale adoption and seamless integration are tantalising close but still elude us. A common theme throughout the literature around educational technology is the feeling that "technology's promise to transform learning in higher education has not been kept". (Privateer 1999:78). Even if the rate of innovation and its use for pedagogical benefit within education is rapidly increasing, this is still often patchy and difficult to sustain.

This is an issue that cannot be ignored - Moore's law denotes the ever increasing importance of equipping our students to navigate an increasingly complex and changeable digital world (see Long, 2002; Santamaria 2012). Yet we still seem unable to evolve ourselves as institutions responding to these changes, and educational technology is still not a natural technological gesture for most of our staff and students - it is still 'not a chair'. (Jenner 2013)

Some of this can probably be attributed to the level of maturity of the technology itself, which is often deployed before it is easy/familiar enough to allow users to achieve their common tasks. In cases where innovators have determinedly sought to 'jump ahead' with immature technology they are often too far ahead of the curve, and have not addressed the basics first. Without a stable enough base of knowledge and practice, innovation therefore continues to remain the prerogative of only the brave and out of reach for the vast majority of users.

A contrasting point also found in surrounding literature suggests that all too often the focus of improvements at an institutional strategic level becomes the technology "as a productivity or information-access enhancer, at the expense of using it to revolutionize pedagogy" Privateer 1999:78. We therefore often seem to recreate previously established tropes- an electronic book, an online form - but not review what could be done (differently) in these new contexts and continue to tackle old problems - student engagement, assessment, group work etc... - with new tools.

The first step in our evolution must be to look at the problems staff and students face, addressing administrative and technical frustrations. We can then move on with a realistic hope of successfully tackling new technology and more adventurous and outstanding academic practice. We therefore need to shift our focus of technology adoption to adaption, and tackle afresh the underlying processes that shape the reality of use to finally ensure that technology "[realises] its true revolutionary destiny" (Privateer 1999:78).

Understanding complexity through an ecosystem

Limiting ourselves to using the VLE as a mere technical support for lecture notes hardly justifies the considerable investment (financial and professional) that our effort demanded. We felt this would have little pedagogic impact for the School moving forward without the re-design of an integrated, cohesive support model, moving towards new "recombinant" ways of working (KnowledgeWorks 2012). To do this we would first need to take step back and look at the bigger picture. In order to try to understand the complex interplay of factors apparent in this more holistic approach we needed a model.

The analogy of an ecosystem to explain and explore the interplay of technology or information is not a new one, and is increasingly the ecological is increasingly apparent in e-learning literature, emerging from earlier concepts of information ecology (Nardi & O'Day 1999), learning ecology (Brown 2000), communities of practice (Wenger 1998; Barab et al. 1999), networks as ecosystems (Kelly 1994), and evident in texts such as Deep Learning for a Digital Age (Weigel 2001) and e-Learning for the 21st Century (Garrison and Anderson 2003)." (Frielick 2004).

Taking the definition of an ecosystem as one where "members benefit from each other's participation via symbiotic relationships", this translates in e-learning as a "digital environment populated by [digital species which], like living species, interact, express an independent behavior, and evolve" (Uden & Damiani 2007:114). Each element or species and the inter-relationships between them deserves equal merit and critical reflection, to improve efficiency, effectiveness and innovation and "create a sustainable learning environment that provides the greatest impact for the learner and their organization" (Spencer 2013).

Ecological survey

Determined to get a clear picture of our needs and review our use of the VLE afresh, it seemed "crucial for the in-depth understanding of online learning environments, and to standardise and promote effective e-learning practices” (Renya 2011:1084) to analyse our learning ecosystem and its different parts. Drawing on Renya’s Digital Teaching and Learning Ecosystem (DTLE) (*ibid.*) model we sought to understand our current position and the ‘health’ of our ecosystem, consulting and involving all those associated in the educational experience.

As part of his ecosystem analogy, Renya identifies two major components: biotic and abiotic.

> “The biotic component comprises two subcategories: organisms cohabiting in the Teaching Niche (lecturer, tutor and e-learning officer) and; organisms cohabiting in the Learning Niche, ([students]). The abiotic component comprises the physical devices that students use to access content ([computers, laptops, mobile devices, etc]); the internet connection [...]; the e-learning interface or portal, and the content, which can be static or dynamic” (Reyna 2011:1084).

As Marshall & Mitchell note, analyses of e-learning often only examine the outcomes of “individual practices”, without a “deeper analysis of the contributions of the institutional context” (2006). To move beyond our current processes however we need a “more holistic approach with a focus on best systems” (*ibid*.). Many of the existing ecosystem models we came across still remained too narrow, only looking at specific interaction between the “lecturer, tutor and e-learning officer” (Reyna 2011) and ignoring the impact of the functional administrative and personal support provided by administrative support teams and professional staff. It was also important to us to not just identify components of our ecosystem and define the structures that they operated in to support learning, but also recognise that biotic components especially inhabit multiple ‘webs’ of “Supporting relationships; goals, skills gaps, feedback, processes, outcomes.” (Spencer 2013). We decided to further examine the relationships of components globally and determine what elements and actions already led or could lead to more “symbiotic” and positive collaboration between them (Reyna 2011).

These alterations to the DTLE model try to take into account the holistic impact of wider process and webs of interaction, to build a more realistic and more human perspective on educational technology use in the School. Armed with these conceptual tools, we therefore decided to conduct our own ‘Ecological Survey’ to similarly identify major components and areas of negative impact and gather requirements for further action.

Methodology

Our methodology was multi-stranded, involving a series of structured conversations and workshops with staff, and analysis of data from staff and student surveys. With this mix of qualitative and quantitative methods we hoped to capture a broad perspective of the School’s needs from across these three groups. In addition, all levels within the School were involved as part of a simultaneous top-down and bottom-up approach (see Frayer 1999), to “encourage ownership and [provide] a direction for developments” (Newland et al 2006). Ultimately we tried to ascertain common themes across the School as a whole, as well as more specific priorities for students, and staff.

To make structured conversations relevant to staff and establish a shared frame of reference, we tried to ensure improvements were an open response to staff feedback, and built up a model to allow interlocutors to situate themselves and their aspirations (see Laurillard’s Conversational Framework, 2002). This was inspired by an initial University-wide ‘Pedagogy Upgrade project’, based on the Edinburgh Napier 3E Framework (2011). This aimed to “help academic staff to consider new or further developed uses of technology that are appropriate for the contexts within which they teach” (2011) within their modules. We expanded this beyond benchmarking and into a model for discussing educational excellence with our academic staff, with these categories 3E categories re-emerged as EEI: **Efficiency**, **Effectiveness**, and **Innovation**.

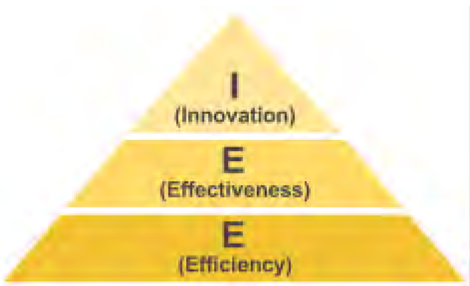

Figure 1: Efficiency, Effectiveness, and Innovation (EEI) Model

A fresh start on a new system was also an opportunity benchmark and look at how (rather than just whether) technology was used for teaching. A Staff Moodle Requirements Survey was sent out in December 2012 to gather anonymous feedback as part of the University-wide VLE upgrade initiative, due in 2013. The results for School staff (49 respondents) were analysed to identify 5 top priorities for improvement in the new system: Group assignments and feedback; Faster adding and more effective management of content; Easier adding of grades and feedback; Improving the integration of other university systems, such as timetabling, within the VLE.

However, even armed with this data, to build a solid foundation we needed to look beyond pure technology solutions and engage our community as a whole in a more shared and consistent effort to evolve together.

Biotic Components

Within the scope of our learning ecosystem we identified three key biotic components: Faculty staff, Programme (Course Office)/Professional staff and Students.

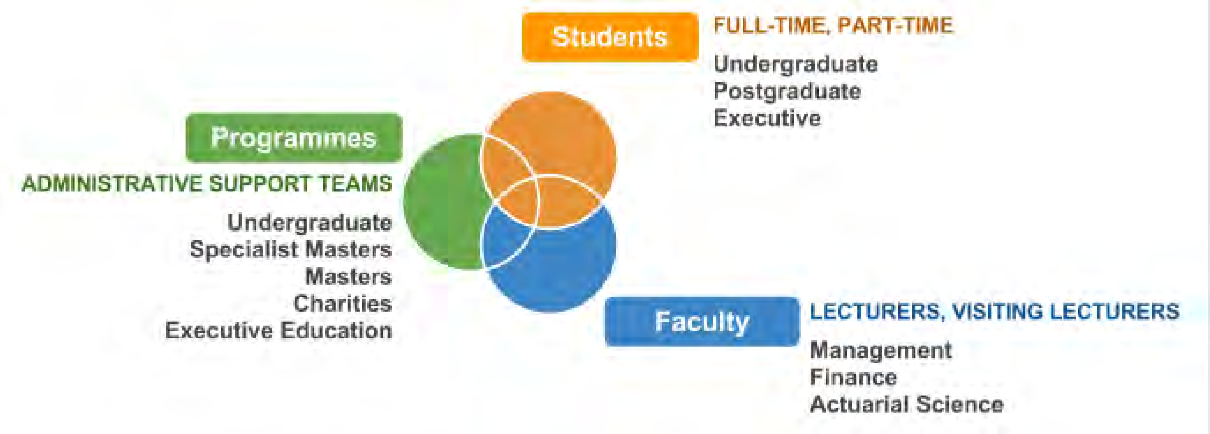

Figure 2: Trifecta of biotic components

Continuing our broad and complex perspective, it was crucial to view these biotic parts as being symbiotic and interrelated - a trifecta rather than isolated initiatives. We therefore set about trying to refine our understanding of this trifecta and its requirements to discover the areas that needed improvement and would provide the "greatest benefits for students and for the institution as a whole" (Marshall & Mitchell 2006).

Clarity and priorities from Staff
We met with the Heads of each Faculty as part of structured conversations to discuss areas of interest or concern and present the School's 'Top 5' VLE improvements for comment using concepts from the EEI framework. This was also echoed in debates in the School's Teaching & Learning (T&L) Committee, which counts members of the School's Academic Quality Services and T&L Champions from each Faculty who raise the profile of educational development opportunities within their discipline and mentor new academic staff. Combined with direction for technological improvements this also had the promise of providing a wider impact of pedagogic benefits.

For our three largest Programme teams (Undergraduate, Specialist Masters and Masters), we ran workshops to map out what support mechanisms they offered to academic staff and students using educational technology, and to identify areas where processes could streamlined. The three Programme teams also never met so we ran a workshop to aid reflection, helping them and us understand their similarities and differences, and rationalise localised practices. Commonalities emerged around inefficient processes around educational technology, making supporting reluctant Faculty staff harder and creating a need for easier reporting and feedback. Distinct difference between different Programmes' processes, reflected in their baseline use, also caused confusion but overall, the day allowed staff to get a broader understanding of how things could work, and plan around educational technology as a group for the next academic year.

Lastly, with a more holistic view of the student experience, we met with curricular and non-curricular support services available to students, including Careers, Library Services and Academic Quality Services. From this we gained a better perspective of the resources available to our students and were able to include these in other discussions with staff, as well as later building these into module templates and processes. This should ensure that paths to student support are consistently and visibly highlighted for all, and that these services have a better quality presence within the educational environment.

Looking through the eyes of our Students

In addition to the results of student feedback from the National Student Survey (NSS), we supported a student-led research project and group discussions around the use of the VLE in the School. Two students surveyed their third year Undergraduate peers, then analysed the 83 responses and collated a report of recommendations. These were often around problems of consistency in communication and information within Moodle, and highlighted a perception that the VLE was only a place to get grades, not an environment for learning. There was also a lack of awareness of the many academic and extra-curricular support opportunities, such as Library Information and Careers.

Alongside other informal group discussions with third year Undergraduate Business in Information Technology students, a clearer representation emerged of how students perceived the system and wanted from it. As recognition for their contribution, the students were offered the opportunity to present their academic paper at the annual Moodle Research Conference. Looking forward, this student-led research offers a great model for engaging with students and gathering feedback, notwithstanding the additional employable skills the students achieved through the process.

Common Themes

From these multiple approaches we gathered key themes across the School, as well as specific priorities for students, each Course Office and Faculties. Alongside our previous actions to build a more cohesive support model and address the system's maturity, we also needed to find:

- Ways to move beyond baseline use and set new expectations for the future, raising educational standards across all courses;
- Better models for distilling and embedding effective teaching practices, offering a wider scope for innovation;
- Providing a more supportive, holistic learning experience by allowing all parts of the trifecta to work consistently in symbiosis;
- Developing better mechanisms for reporting and review of our ongoing recombination models

Shared expectations

Part of working together is knowing what support you can expect from your colleagues, so we set out to make explicit the relationship webs in which each component plays a part. Just as symbiotic relationships within an ecosystem are caught in a delicate equilibrium, we increasingly felt that progress and stability would rely on all parts of our trifecta being aware of their interdependence and working together to a shared understanding.

Based on our conversations and research we therefore set about trying to express some of the basic principles that could, or should, underpin how these components interact. We also realised, from a reflexive perspective during discussions that we the E-learning team, established to support the use of educational technology within the School, were also a key part of the School's learning ecosystem, and added what we hoped summarised what we had to offer.

The shared expectations statements below seek to establish the shared expectations of what each biotic group can offer each other and what they should be able to expect in return.

Faculty (Lecturers and Visiting Lecturers): Faculty, working in partnership with the Course Office, will provide a supportive learning experience to distill educational excellence and strengthen Student learning.

Course Office (with other Professional Services): The Course Office will provide a consistent point of contact for Students engagement while working in partnership with Faculty to provide an efficient educational environment.

Students: Students will engage with the Course Office through consolidated support mechanisms while developing their educational strength with the culmination of educational excellence.

Educational Technologists: Interweaving this model are Educational Technologists who facilitate initial discussions and provide a framework for the sharing of good practice by embedding any efficiencies directly into the technology that everyone uses. We ensure the stable set-up and tailoring of these processes in the

VLE/other (abiotic) technologies, with good feedback channels in place for all parties involved. Once this common framework and support base is established for all to refer to, we then provide training and specialist expertise around effective and innovative practice.

Abiotic components

While seeking to look beyond pure implementation and adoption of technology, educational technology “abiotic components also have roles which contribute to the organisation of the system” (Reyna 2011:1085). To move our educational technologies towards becoming natural technological gestures, they must be mature, stable and pedagogically relevant from the beginnings of their adaptation. If we wanted the VLE especially to be deeply embedded we needed to address the system’s maturity, and improve its functionality and make it more user-friendly. For shared expectations to be a success, and make moving beyond effortless and attractive, initial effort must be put in to establish the basics and ensure our systems are tailored and fit for our purpose.

A template for excellence

In conjunction with the shared expectations which explicitly highlighted working relationships, points of contact and services were also embedded across templates for VLE courses. This should ensure that across all levels of a Course’s online presence (Programme, Degree and Module) everyone has easy and obvious access to relevant academic, administrative and extra-curricular information. Beyond streamlining support and processes, this also tried to address issues of consistency to build a better, more reliable and familiar learning environment.

Three standardised support blocks, set to appear in the same place on every School module template, form the basis for more embedded and consolidated support services and resources. This should ensure that across all levels of a modules’ online presence (Programme, Degree and Module) students (and staff) have easy and obvious access to the relevant academic, administrative and extra-curricular information. Centralised support modules, consistently linked through the standardised blocks, were designed to encapsulate knowledge from across the School for both Students and Staff and improve knowledge management and increase dissemination. For VLE help, separate online induction modules for staff and students hold relevant guides while purely technical problems are redirected to IT.

In addition our templates also aim to reduce unnecessary technical complexity for staff and make good educational practice the norm, taking and embedding best practice in terms of set-up from all three Programmes. This seems key to allow all staff to concentrate on more effective and innovative ways of sharing their knowledge and engaging with students.

To provide a consistent model for baseline coursework assessment, modules now include a Coursework Assessment section with model assessment ‘shells’, with the section as a whole restricted from students until they agree to a pre-set submission statement. Guidance is also built-in, with staff guides located next to activities, and assessment instructions for students outlined in the pre-populated shells.

Adapting the VLE

Though much of the work so far may seem pragmatic and down-to-earth, we hope it is understandable that this groundwork is necessary to give a stable environment where more elaborate and innovative teaching and learning methods can grow and be shared. Our work around these templates is an attempt to respond to the constraints of working with a tool that is not perfectly designed for our needs. However, it is hoped that this way of working gives students the consistency and access to support they expect and deserve, while easing the technical burden on staff leaving them more energy to support greater developments towards more innovative and inclusive teaching.

We also looked more broadly at fundamental institutional issues, understanding that these processes would also shape users’ experience of the VLE and other media-based improvements. To make these easy to use and reliable we sought to embed the necessary technical requirements for incorporation into development of University-wide IT infrastructure.

Alongside the School’s individual requirements, the University also focussed on ensuring efficiencies were built-in. A University Usability study was undertaken which highlighted continued points for improvement, some of which could be achieved by the updated VLE while others still required further customisation. These resulted in three areas for improvement, overall look and feel, navigation and easier access to personally relevant content. These lessons learnt were then shared back to the wider VLE community, feeding back improvements we had requested and tested to continue our mission to share best practice.

Conclusions

The process of change and recombining practice to build principles of action which empower and support an excellent educational experience is likely to be a long and complex journey. However, we have taken the first steps in our evolution by looking at the learning ecosystem more broadly and moving away from replicating purely tool-based or pedagogic approaches. By making explicit and addressing the relationship and technical problems staff and students face, we hope to position ourselves to better "leverage changes in technology practices to meet increasing demands" (Grajek & Pirani, 2006:9).

Set in a constantly changing digital world, we are concerned with building practical principles and heuristic models that enable actors within the learning ecosystem to understand their environment and shape their digital future accordingly. It is important to emphasise that the model above does not seek to apply a 'one-size-fits-all' attitude, but build methodologies for requirements gathering and development which are flexible and agnostic, allowing us to respond to environmental pressures and maintain a healthy learning ecosystem.

Next steps

Having upgraded to a new VLE and hopefully built a solid foundation with the agreement and hard work of our community as a whole, our next steps are now to move beyond the basics, beyond current methods and ideas, to do things to support excellent student learning that were just not possible before. Part of this will involve examining how to recombine better models for distilling and embedding effective teaching practices, raising the bar across the School and allowing us to aim beyond mere stability towards innovation and new forms of education.

Though our plans for the future must be tempered with the practicality of the present to be realistic, we are also wary of being caught unawares again by a rapidly moving technological and educational context. We are required to actively evolve our practice, or "risk letting the disruptions of the coming decade perpetuate inequities for learners, undermine the learning ecosystem's capacity to adapt, and narrow the impact of education innovations by keeping them largely uncoordinated, opportunistic, and fragmented" (KnowledgeWorks 2012:3).

To maintain our momentum and stay true to our dreams, we need to improve our technology to better "facilitate delivery of readily accessible and useful metrics[, allowing us] to recognize and realign incentives and investments that induce positive change in learning, teaching, admin processes, etc" (Grajek 2012:9). Review and report points are already being set with Course Offices and we are looking to use new functionalities in the VLE to track points of engagement and disconnection by staff and students using the system. We also want to build on our successful student-led research practices and engage our community of users as a whole more in review processes, drawing on usability testing and the expertise our staff hold in data analysis and modelling.

Closing remarks

Having reflected upon our previous experiences and our present challenges we have broadened our perspectives and are now at the stage of sharing, refining and trying to recombine our processes and practice. We feel that this ongoing and reflective evolution is key to Business School X's ambition of offering an enhanced, and continually outstanding, educational experience. Though Business School X and the wider University are going through a time of change we are determined to support staff and students to the best of our ability and ensure that education at the School continues to deliver an educational experience that provides both academic rigor and opportunities for student to expand their capabilities based on interests and aspirations.

We hope you will find this attempt to explore new ways of thinking, working together, and educating, a thought-provoking example of a reflexive yet practical approach to embedding educational technology at the heart of Higher Education. We look forward to testing the strengths and areas for improvement of these new paradigms and sharing these once again in the global community.

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Dreams, hiccups and realities: What happens when lecturers and students co-design an online module?

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Negotiating curriculum design *with* students *for* students involves incorporating both the students' needs and the lecturers' requirements into the course structure, learning activities, resources and assessment tasks. In 2012, two lecturers and a group of first year undergraduate students worked together to design an online module within an on-campus course for a second year teacher education degree. During the semester when the online module was conducted, data were gathered from the lecturers and students in the course. Findings from analyses of these data are presented in this paper in terms of: 1) the lecturers' and students' initial dreams and plans when the online module was co-designed; 2) the hiccups and problems encountered during the online module; 3) the realities of the successful aspects of the online module; and 4) the lessons learned for future emergent and negotiated curriculum design practices in higher education contexts.

Keywords: emergent curriculum, negotiated online course design, students and staff as co-designers

Introduction: We had a dream

> "A dream you dream alone is only a dream. A dream you dream together is reality."
> — John Lennon

In 2012 we had a dream – to put into practice the practical and theoretical ideas of the emergent or negotiated curriculum (Garraway, 2010; Williams, Karousou, & Mackness, 2011). Coupled with the practicalities of one of the lecturers living overseas for six months while still teaching on-campus and online students, we ventured into a journey of negotiating and co-designing the structure and assessment tasks of an online module as part of an on-campus course with a group of first year undergraduate teacher education students.

Co-designing an online module about assessment and evaluation for teacher education students, within an on-campus professional experience course, provided an opportunity to respond to students' needs and learning preferences *before* the module was offered the following year. Although not a great deal is yet known about "how authority is negotiated in different classroom contexts, particularly in teacher education settings" (Brubaker, 2012, p. 159), some educators have incorporated the use of student expertise into their course design processes (Kiggins & Cambourne, 2007; Onwuegbuzie et al., 2012; Singham, 2005). By adopting this emergent curriculum design approach (Garraway, 2010; Williams, et al., 2011) students in the first year of their degree engaged in the process of designing the sequence and structure of the topics and assessment tasks of an eleven-topic online module in the year before the module was offered as part of their second year degree structure. Although the content and learning outcomes of the course were determined before the negotiation process began, the timing of this approach enabled the students and lecturers to work together on some aspects of the assessment tasks, including the marking rubric.

This paper outlines the design process and reflections on how the online module was perceived by staff and students during the semester it was offered. Data were gathered from the lecturers and students in the course and analysed during the semester the online module was conducted by tracking regular email feedback, by content analysis of students' responses to open-ended questions about the online module and lecturers' reflection comments about students' experiences while the online module was being conducted.

Our journey into dreams, hiccups and realities

Our dreams: Co-designing

In 2012, the students and their lecturer adopted Biggs' principles of constructive alignment (2003) whereby the aims, learning outcomes, content, teaching methods, assessment and evaluation are all tightly aligned to provide a meaningful and transparent learning experience for students enrolled in the course. Biggs' principles were applied to ensure that the intended learning outcomes of the course were incorporated into all aspects of the module's design. As such the learning outcomes of the overall professional experience course were used to lead the design of the learning activities and assessment tasks that formed the basis of the online module.

By using Biggs' constructive alignment to provide an overall interlinked structure for the online module, Wiggins and McTighe's (1998) backwards design model of curriculum design was adopted as a guide to developing curriculum materials. Of the 42 students enrolled in the course in 2012, 9 of these (21%) volunteered to assist in developing the online module during the year before the module was delivered. The group who volunteered were a representative sample of the whole cohort in terms of gender and age. We began the planning process by developing an overview of the assessment tasks which the students would complete across an eight week period during the latter part of the regular thirteen week semester. Planning sessions took place during on-campus meetings and through online communication with students who volunteered to act as co-designers of this assessment module. The planning sessions occurred on three occasions in the semester of the previous year to the course being delivered. Students and lecturers met in agreed learning spaces to plan the online module. During these planning sessions, the course learning outcomes were analysed and discussed, assessment tasks were brainstormed and constructed, and the students' ideas about learning activities and resources were recorded against each of the learning outcomes. Some students found the process somewhat confronting, to be designing their own curriculum through a process of devolved authority (Singham, 2005), but they soon became more comfortable with the process, especially when they perceived that their suggestions were being implemented. Based on their experiences in the first year of their course, the students expressed preferences for assessment tasks at regular intervals, rather than a heavily weighted single assessment task. From these negotiated discussions and online collaborations, a set of assessment tasks was developed. As a result of the students' preferences and the requirements of the learning outcomes in the unit, the following assessment tasks were designed:

- **A rationale** for using assessment in the primary school; and
- **A series of short online quizzes** covering knowledge and skills developed during the online module.

The planning process developed into a series of three informal guided workshops which enabled the students to experience the practical applications of Biggs' and Wiggins and McTighe's theoretical models and principles. Once the assessment tasks were outlined, large pieces of poster paper were used by the lecturers and students who were to be involved in the course to draft out the design of the module, based on the non-negotiable learning outcomes from the course outline. These initial designs were then transferred to electronic documents which were circulated among the students for feedback and further suggestions. From these online and on-campus discussions, a common format was developed for each of the eleven topics of the online module which incorporated the following components:

- **Overview** of the topic including a topic summary, list of readings, assessment task reminders;
- **Introductory mini-lecture** in an mp4 movie format (including graphics, text and audio);
- **An independent online activity** which facilitated knowledge construction, skills practice, resource analysis and reflection, such as a webquest (Abbit & Ophus, 2008; Dodge, 1995, 2001), analysis of assessment examples, observing and analysing videos;
- **A collaborative online activity** which was e-moderated by lecturers (Salmon, 2011) in which students shared their knowledge developed throughout the topic, such as a forum, a collaborative quiz or a discussion of webquest findings; and
- **A revision checklist** that provided a self-check strategy to enable students to track their own learning.

As a result of the negotiated design which was contributed to by lecturers and students, the online module of this professional practice unit replaced the two on-campus lectures that were presented each week in the fully on-campus version of the course. The topics remained the same in the previous and the current version of the course but the delivery method and the assessment tasks were more suited to the online learning environment.

Our hiccups: Technical and conceptual

A number of students experienced some problems with accessing online materials due to internet connection problems and institutional system problems which impacted on the reliable availability of online materials in the Learning Management System (Moodle).

> The least effective aspect would have to be the difficulty we often experience with accessing materials such as readings or lectures as they are all online and technology has a tendency to play up.
>
> The availability and compatibility of the lectures and readings on various computers was problematic. Often they wouldn't open or run.

Based on the low number of emails received pertaining to technology-related issues associated with accessing materials, it can be surmised that students generally were successful in accessing online materials.

In addition to comments about technical issues, the main area of dissatisfaction with the online module was conceptual; students did not necessarily understand or conceptualise how online learning could be facilitated when most of their learning experiences had been based on face-to-face classes throughout their higher education and previous secondary school experiences. Furthermore, our data analyses indicated that some of the students did not appear to be comfortable with the degrees of accountability and independence that were required and expected of them as part of the online activities and assessment tasks:

> I don't really like online lectures, I never focus properly and am not motivated. I prefer being in a classroom with a teacher.
>
> I find it difficult to take notes of my own accord, I would rather complete and submit certain tasks during the lecture itself.
>
> I feel as though I learn a lot more in face to face lecture and tutorial time for a subject like professional development, much more than I do online

Brubaker (2012) also found that, when attempting to involve students democratically in the shared responsibility of course creation and student-driven activities, students were sometimes reticent. Because they had more experience with teacher-focused, transmission-oriented instructional approaches and course materials (Singham, 2005), they were not always comfortable or willing to engage in learning situations in which teachers took a less authoritarian role.

Our realities: Format, flexibility and collaboration

Just over a third (14 of 39 students, 36%) of the students enrolled in the 2013 course responded to an online questionnaire which requested comments about their experiences of the online module. They mainly commented on the clarity of the format in which the online materials were presented:

> The instructions given are really clear …
>
> I like how everything has been set out - very easy to understand and clear instructions.
>
> I liked the format of the assessment module, how each step is clearly stated and labelled and a checklist is provided at the end.

The students also appreciated the flexibility of the online module as it “could be received at our own pace” and “paused when required and returned to at leisure”. Students typically referred to the options they were given in relation to timeframes: “I like the online lectures and being able to do them when I have time”.

As well as commenting on the functionality and organisation of the module, students expressed ideas about how the online module and assessment tasks impacted on their learning:

> I really felt like I received a greater understanding due to the "Rationale" assessment task. There was quite a lot of detail required for this task therefore I was able to research concepts that were not made clear to me otherwise.
>
> The course is applicable and relevant to real teaching.
>
> The online lectures were very engaging and I learnt a lot despite not being in on-campus classes.

Towards the end of the online module, one of the lecturers who taught in the course summarised her observations of how the students perceived the online module:

> The results so far confirm what I have heard from the students. They are discovering that doing a module by distance puts them more in control of their learning and they are not sure they like having that responsibility. Also they are discovering it takes a lot more brain power than merely being present in a lecture.

The students' perceptions about how the lecturers worked together across the on-campus and online modules illustrated an understanding of how the "behind-the-scenes" planning of the unit was undertaken in a collaborative manner:

> You have both really put a lot of effort into doing these online modules, which I SUPER appreciate! I'm so glad that Avondale has tech savvy lecturers :)
>
> Thank you so much for all the effort you have put into collaborating and presenting these online lectures.

Conclusion: Our future dreams

Based on an analysis of our initial dreams, and some of our ensuing hiccups and realities, many lessons have been learned to take forward into our future dreams of co-designing online modules with students and staff.

In conclusion, some of our dreams were put into practice. Our students gained a greater awareness and appreciation of the process of curriculum planning and assessment design. We also experienced our fair share of hiccups – some expected and some not. However, all in all, the experience of co-designing an online course module *with* students, not just *for* students, culminated in a rich set of lessons learned by staff and students about course design, online relationships and the perceptions of online learning.

The main "hiccups" experienced were related to technical difficulties, misconceptions about online learning and students' preferences for a teacher-oriented learning context (Brubaker, 2012). Mostly, the technical difficulties can be overcome in future iterations of this course by some relatively straightforward modifications of the online materials and by streamlining some access options within our Learning Management System (Moodle) and e-reserve library resources.

One of the main benefits of this process that involved the co-design of on online module by a partnership between lecturers and students was that students were able to experience the intersection between theoretical ideas and practical strategies while they contributed to the design of a course in which they were enrolled. The "power" was shared between lecturers and students (Winograd, 2002). As a result of this process, students were able to take more ownership of the structure and design of their course as well as their own learning. We learned that students were not necessarily aware of the value or benefits of online education and that they needed more guidance than we provided to regulate their learning in order to engage in practices which enabled them to work as independent learners. Overall, implementing negotiated processes to develop a curriculum that reflected the needs and interests of both lecturers and students enables both groups to work together, towards a common set of learning and teaching goals. We plan to further refine the strategies we used in Semester 1, 2013 with our new cohort of first year students in Semester 2, 2013 to co-design selected components of our second year courses that will be offered in 2014.

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Pipe dreams or digital dreams: Technology, pedagogy and content knowledge in the vocational educational and training sector

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Regional Australia provides fertile ground for the integration of online technologies to support the vocational education and training (VET) sector. This paper examines teachers' beliefs about teaching with technology in a regional VET institute. VET teachers must demonstrate teaching expertise (pedagogical knowledge) and industry expertise (content knowledge) for diverse learners and contexts; however, the emergence of new digital technologies illustrates an increasing need for teachers to embrace 'technology' knowledge commensurate with industry practice. Recent surveys have revealed that teachers' use of online digital technology within the VET sector is not effectively incorporated nor has it been embraced in pedagogically defensible ways. This paper adopts a mixed methods approach to understand how the epistemic beliefs of VET teachers influence their teaching and how the TPACK is applied in practice. Finally, this paper illuminates the need for professional development programmes to focus on developing teacher knowledge across all TPACK domains.

Key words: VET sector, TPACK, epistemic beliefs

Introduction

Over the last few decades, there has been increasing pressure on teachers to integrate digital technology tools into their practice. This presents a significant paradigm shift within the vocational education and training (VET) sector. The potential for effective teaching with technology can be a powerful means of effecting change in people's lives, reducing the tyranny of distance, which has previously blocked access to education for marginalised and minority groups, many of whom reside in regional areas (Dhanarajan, 2001). The potential for effective online teaching and learning for regional Australians can achieve this goal; however, the success of these experiences is reliant on the teachers' skills in using technology effectively, their beliefs about being able to do so and their knowledge about teaching. The research aims were to explore the reasons for low integration of online technology by VET teachers in regional Australia. To achieve this, a framework was identified which would provide a lens through which to examine the role of technology in teachers' knowledge alongside their beliefs that influence the decision to integrate technology.

VET sector

Within the VET sector it is possible that technologies for education are being used in traditional epistemological ways to guide VET programs and pedagogic practice (Robertson, 2007). The rapid growth of the knowledge society challenges these traditional epistemologies and their means to prepare students for the workplace (Tsai, Chai, Wong, Hong & Tan, 2013). VET products, 'training packages', contain the curriculum that industries require, stipulate the standards for competent performance, dictate the knowledge and skills required as well as the critical aspects for gathering evidence for assessment. Assumptions about the nature of knowledge and how it is acquired and used are reflected in the curricula, delivery and assessment strategies (Pratt, 1992). In the VET sector, the teacher implements these programs thus influencing what counts as knowledge and how that knowledge is acquired (Hofer & Pintrich, 1997; Pajares, 1992). It is commonplace for teachers to begin teaching with a rich content knowledge of a particular trade or vocation. This is based on an assumption that they bring with them knowledge of the tools and the technology of that industry as well. Recent criticism of the minimum requirement (the Certificate IV in Training and Assessment) to become a VET teacher has indicated that many graduates of this qualification may not have developed sufficient pedagogical knowledge to inform their teaching practice (Wheelahan, 2010), let alone the technological knowledge required to integrate that technology. Yet, they must demonstrate teaching expertise and industry expertise across diverse contexts and learners. The emergence of new global digital technologies illustrates an increasing need for teachers to develop an additional set of knowledge, particularly in light of industrial change. Therefore the pressure on VET teachers to integrate online technology effectively has never been more compelling. For that reason, this research aims to explore the current situation of VET teachers in relation to their technology, pedagogy and content knowledge and in particular explore their belief systems about teaching with technology. The questions which have guided the research are:

1. What is the relationship between VET teachers' technology, pedagogy and content knowledge?
2. How do teachers' epistemic beliefs influence the integration of technology in a regional VET context?

Theoretical framework

Teacher preparation programs are often held accountable for failing to adequately prepare teachers to establish pedagogical connections between the pedagogy and the technology. The framework at the centre of this research is grounded in an understanding that quality teaching does not occur when the three knowledge bases of technology, pedagogy and content exist separately. The specific type of knowledge required is technology, pedagogy and content knowledge (TPACK), a unique body of knowledge constructed from the intersection of the three knowledge bases with the centre indicating maximum technology integration (Mishra & Koehler, 2006). It has its origins in Shulman's (1987) seminal work where it is argued that the most central area of knowledge is the construct Pedagogical Content Knowledge (PCK), that which differentiates the teacher from the expert (Shulman, 1987). TPACK has emerged as the amalgam of PCK and technology (Angeli & Valanides, 2009). The TPACK framework has practical appeal in that it offers an analytical lens through which to structure professional development programmes, in particular a structure for researching what teachers know and should be able to do. It has the potential to examine how technology is expressed within a teacher's belief system (Bates & Maor 2010; Jimoyiannis, Tsiotakis, Roussinos & Siorenta, 2013). The way in which this research applies TPACK is to examine the relationship between VET teachers' technology, pedagogy and content knowledge through a survey, the purpose of which is to identify teachers' skills in using technology effectively, their beliefs about being able to do so and their knowledge about teaching specific content in order to understand better their pedagogical and personal beliefs relating to successful technology integration (Ertmer, 2005).

Epistemic beliefs

Epistemic beliefs are core beliefs about the nature of knowledge and knowing, how one comes to know things (Hofer & Pintrich, 1997: Harteis, Gruber & Hertramph, 2010). While the TPACK framework does not necessarily acknowledge teachers' epistemic beliefs (Angeli & Valanides, 2009) it is proposed that such beliefs significantly influence technology integration and have a major bearing on whether the technology is used in constructivist or traditionalist ways. Epistemologically, it is contended that the more elaborate a person's set of epistemic beliefs, the better the learning and teaching performance. Thus, the epistemic beliefs held by teachers and trainers may have a significant influence on what students come to believe about the nature of knowledge and what it means to learn. This assertion implies that where knowledge that is believed to be fixed is reflected in teacher centred approaches whereas beliefs that knowledge is not fixed and evolving tends to be more student centred (Buehl & Fives, 2009). Research suggests that teachers with traditional pedagogical beliefs apply a didactic approach to technology integration whereas teachers with more constructivist beliefs and pedagogical practices use technology more meaningfully and more often (Tondeur, Hermans, van Braak & Valcke, 2008; Park & Ertmer, 2008). Epistemic beliefs therefore are important to this research in that they are identified as having significant influence over a teacher's belief system suggesting that the way one teaches is directly connected to one's personal beliefs about knowing and knowledge, teaching and learning.

Methodology

This research adopted a mixed method design using both a survey and a semi structured interview to explore how the epistemic beliefs of regional VET teachers influence their teaching and how their TPACK is applied in practice. VET teachers represented the primary data source. The survey was based on an existing instrument (Archambault and Crippen, 2009) and was modified to reflect a VET context. Twenty five teachers who volunteered to participate in the research completed the TPACK survey. From the survey results, 14 teachers were selected for an interview based on the criteria of the highest, mid-range and lowest scores. In total, five of the highest scores, five of the mid-range and four of the lowest scores were selected for interview. Interviews took place at the teacher's workstation which provided the interviewer access to the teaching materials, software, resources and technologies that the teacher was using. The semi-structured questions were designed to explore teacher's beliefs about technology, the content they teach and how they teach it as well as their beliefs about the nature of knowledge and learning.

Data analysis

Quantitative data obtained from the TPACK survey was analysed using both descriptive and inferential statistics. The seven subscales are presented in Table 1: Pedagogical Knowledge (PK), Content Knowledge (CK), Technology Knowledge (TK), Technological Content Knowledge (TCK), Technological Pedagogical (TPK), Pedagogical Content Knowledge (PCK) and Technological Pedagogical Content Knowledge (TPACK). The measures included the mean and standard deviation for items (a) through to (x) to answer the question, "Please rate your ability to undertake the following tasks associated with teaching in a VET context?" Qualitative data was obtained from the semi-structured interviews. Each interview was recorded and transcribed verbatim. TPACK related themes and categories emerged and were used as a basis upon which to identify teacher beliefs. Each interview took 40 minutes, however, for the purpose of this paper a small selection of excerpts is presented to complement the quantitative data.

Results

In order to answer the first research question about the relationship between VET teachers' technology, pedagogy and content knowledge, a summary of survey responses are illustrated in Table 1. Teachers rated their knowledge highest for the scales of pedagogy (3.53), content (3.46) and pedagogical content (3.41). Technology knowledge was reported significantly lower (2.64) than both pedagogical and content knowledge but rates even lower in the intersection of technological pedagogical knowledge (2.25) thereby suggesting that while technology knowledge was low, knowledge of how to use technology to teach in an online learning environment was even lower. What is also apparent is that these teachers do not feel they have the knowledge or the skills to troubleshoot hardware and software technological issues for both themselves and their students. These results indicate that VET teachers report to be most uncomfortable and unconfident with aspects of technologies in their learning environments with which they are unfamiliar.

Table 1: Summary of descriptive statistic for the TPACK results

Descriptive Statistics						
Domain	**N**	**Range**	**Minimum**	**Maximum**	**Mean**	**SD**
PK	25	2	2	5	3.53	0.62
TK	25	3	1	4	2.64	0.85
CK	25	2	2	5	3.47	0.57
PCK	25	3	2	5	3.41	0.61
TPK	25	3	1	4	2.25	1.05
TCK	25	3	1	4	2.69	0.94
TPACK	25	3	1	4	2.61	0.81

In order to answer the second research question of how teachers' epistemic beliefs influence the integration of technology in a regional VET context, interview data were transcribed and analysed. Interview analyses are organised and presented as TPACK themes. A snapshot of the VET teachers' belief system is presented below.

***Technology*:** Teachers generally believe that the role of technology is to support traditional teaching practice: as an administrative aid; *I think technology has made it easier and we haven't spent much time using the photocopier*, as a mechanism to enable file dissemination; *It is an Excel spreadsheet and it has coloured links to his students and his course materials so when his apprentices come onto Block Release and they need an assignment or a file, he sends it electronically*, and as a conduit for the delivery of content; *We have a folder on the LMS and it contains the course information and the assessments they will need to pass*.
***Pedagogy*:** Teachers' pedagogical beliefs were firmly grounded in instructional pedagogy with a focus on delivery of content (*Content is provided to the student by the teacher and the student's role is to access that content from the LMS*). Other responses related to perceptions that teaching is a process whereby knowledge is

imparted by the teacher to the student: *To teach means to impart knowledge into a person so they can understand what it is they are going to be doing,* and *We give advice as to where to go and what to do and walk them through their assignments and what we will assess*. However, there was evidence that teachers had few tools for thinking about how to make the shift to constructivist pedagogies and therefore plans to use technology were couched in language of the future as demonstrated in the following excerpt*: I hope to do an online course next year.. and use technology differently,* and *I want to make Blackboard a bit more interactive when I have the skills.*
Content: Teachers described the importance of covering the content, believing that the content of what they teach is prescribed, contained in training packages, and can only be delivered in certain ways. This was evident in the following quotes: *The LMS is just a platform for our information because the content is from the Education Department and our students need to know about the legislation and policies and so we send them to their website to see their policies*, and *I am using this LMS because the learner guide we have access to is from two training packages ago..*
Knowledge: Teachers' epistemological conceptions, for the most part expressed knowledge as being external to the learner, existing in texts and learning guides, not able to be challenged and contested as demonstrated in the following quotes: *Students still have to read their textbook and that's where their learning is done*, and *We take them through the assessment plan with the information they need to pass and we say that their assessments will guide them through their studies*.

Discussion

While the interview analyses suggest that VET teachers express and espouse traditional beliefs and views regarding pedagogy and content knowledge, constructivist orientations to the affordances of digital technologies in online environments will remain a pipe dream. The survey results show that teachers tend to rate the pedagogy and content knowledge higher than what is reflected in their teaching practice suggesting that teachers report being most comfortable and confident with aspects and perspectives of traditional teaching environments, using their experiences and skills associated with face to face environments. While teachers integrate online technology in varying degrees, their use of technology reflects traditional approaches to teaching. Technology use is shaped by the teachers' belief systems: beliefs about technology, pedagogy and content and beliefs about knowledge. The implications are of particular importance for teaching in the VET sector where an important role of the teacher is to prepare students to undertake high level and complex tasks in the workplace.
Based on the data presented in this paper a contradiction exists between teachers' TPACK and their expression of beliefs relating to knowledge and teaching which might help to understand why technology is not being integrated as well as it could be within the VET sector. The learner-centred, constructivist approach to teaching with technology is in conflict with the teacher centred, traditional approach to teaching using technology. Clearly, other contextual factors are at play. The self-reporting nature of the survey asked teachers to rate themselves and their ability to operate in an online environment; therefore the teachers' responses are limited only to what they believe about their ability. If teachers adopt practices that are consistent with these belief systems (Tondeur et al., 2008) this in itself is insufficient to bring about a paradigm shift towards constructivist teaching within the VET sector. This research has exposed a contradiction between teachers' self-report about their teaching, their epistemic beliefs about knowledge and the influence of these beliefs on the integration of digital technology in regional education. Our next stage is to consider what to suggest in terms of professional development that will merge the TPACK domains and therefore make teaching in regional Australia more of an electric dream than a pipe dream.

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Augmenting learning reality: iPads and software as cognitive tools

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In the three short years since the release of the iPad, it has become the object of substantial investment in a number of areas of education. This investment is driving the need for significant research into mobile device related teaching and pedagogy. The focus of this paper is on the first iteration of a design-based research study, which is informed by theories of authentic learning, cognitive tools and mobile learning. This paper is an introductory exploration into the use of iPads, and the apps and services they run, as cognitive tools in an authentic tertiary learning environment. This paper highlights a range of iPad apps and Web 2.0 services used in the study, and methods for their potential use to augment the learning experience in a business education context.

Keywords: Cognitive tools, authentic learning, mobile learning, iPads, business education

Introduction

The iPad has been somewhat of a revelation in the education world. For better or worse, it has stood out from the pack of other technological gadgets and drawn the attention of many responsible for the management and provision of education around the world. Local examples of this include the recent deployment of 12,000 iPads to students and staff at the University of Western Sydney (Whibley, 2012) and the requirement for all students to own iPads (as the preferred device) at Orewa College in Auckland (Orewa College, 2012). However, there is a real need for the development and dissemination of research informed teaching and pedagogy to make the most of this investment. One such applicable area of research is that of cognitive tools (cf, Jonassen & Reeves, 2004; Kim & Reeves, 2007). This paper outlines the preliminary planning and tool selection of a larger investigation into the use of tablet devices as cognitive tools, which augment the student learning experience within an authentic mobile learning environment.

Cognitive tools

Just as carpentry tools enable builders to extend their capabilities to create structures and objects that would be difficult without them, learners can employ 'cognitive tools' to support their learning and assist in the creation of authentic products. Anecdotally, some writers describe how it would be almost impossible for them to write without the support of the word processor as a cognitive tool. Steve Jobs (2006) described computers as 'bicycles for the mind', capable of taking you further and faster than you would expect without them, and Cochrane and Bateman (2009) described smartphones as 'wings' for learning. Also referred to as *cognitive technologies* (Pea, 1985), t*echnologies of the mind* (Saloman, Perkins, & Globerson, 1991), and *mindtools* (Jonassen, 2000), *cognitive tools* have been described by Jonassen and Reeves (2004) as "technologies, tangible or intangible, that enhance the cognitive powers of human beings during thinking, problem-solving, and learning" (p. 1). Computers, smartphones, mobile tablets and the software applications they support, are all examples of cognitive tools. Viewing these devices as cognitive tools shifts the focus of the devices from being a medium for the delivery of content to a platform for the creation of knowledge (Oldfield & Herrington, 2012). Jonassen et al. (1998) propose that mindtools have the capability to engage learners in critical, higher-order thinking about content because: the learners are the designers; the focus is on knowledge construction, not reproduction; learning is in partnership with technology; they are unintelligent tools, relying on the learner to provide the intelligence; they distribute the cognitive processing; and they are cost and effort beneficial (p. 13).

While much of the previous research into cognitive or mindtools has focused on the tool and the learner, Kim and Reeves (2007) suggest that the learning activity is also a critical component to be considered. They state that the learner, the tool and the activity form a joint learning system, where the *expertise* element of learning that is used by the learner is reflected in both the tool and the activity. They have aligned the theories of distributed cognition and expertise to paint a clearer picture of the meaning of cognitive tools. In doing so, Kim and Reeves (2007) propose the following redefinition of cognitive tools: 'Cognitive tools are technologies that learners interact and think with in knowledge construction, designed to bring their expertise to the performance as part of the joint learning system' (p. 18). This functionality could be used to support authentic learning, as is explored in the next section.

Project brief

Students enrolled in a first year business information systems course were loaned an iPad for the duration of a semester course. There were 60 students in the course, spread over two different streams, one with a single three hour class at night, and the other with two 2-hour classes during the day. The course was designed based on the key elements of authentic learning, proposed by Herrington and Oliver (2000; Herrington, et al., 2010) focusing on a series of authentic tasks within the context of an animal-themed adventure tourism company. The course design enabled collaboration between students within a strongly scaffolded learning environment. A key aspect of the course design was the incorporation of iPads to be used as cognitive tools (Jonassen & Reeves, 2004) in a manner informed by the mobile learning critical success factors developed by Cochrane (2010).

The cognitive tools

All students in the course were issued an iPad in the first week of class. There were two models of iPad used in this project: 35 iPad2s (16GB wifi only) and 30 iPad minis (16GB wifi only). These were the least expensive models of iPad that were on sale at the beginning of this project. It was decided that equipping the students with the devices was the best option for this study as it would remove any existing inequities amongst the students and enable the full participation of any student who wanted to be involved in the project.

Why the iPad?

The iPad has dominated the new tablet category that it created since its launch in 2010. Despite the launch of hundreds of models of Android tablets, and the release of Windows 8, the iPad continues to be the market leader. Many businesses and other larger organisations are either trialing or implementing the iPad. Some recent high profile examples of iPad adoption include the New Zealand Police issuing iPads and iPhones to all front line police (New Zealand Police, 2013), and airlines making iPads part of their flight entertainment kit (Apple, 2013). It has also become a popular tool in education, with many New Zealand schools requiring the devices. Perhaps the most significant example of this is the roll out of 12,000 iPads at the University of Western Sydney for all commencing students (Whibley, 2012).

There are also a number of practical reasons for the use of the iPad. The Apple iOS platform is more secure than the Android platform (one of the reasons why it is popular with business). This is largely due to the controls that Apple place on both the operation of the device and its App Store, which is the only place to download applications. The iPad and iOS experience is also consistent across devices, for example the iPad2 and iPad mini devices work in exactly the same way, so it is easy for the teaching staff and student peers to provide support for their use. As a general rule, Apple devices, and they are seen to be user friendly, as can be seen from the results of recent customer satisfaction surveys (Power, 2013). Utilising products that are user friendly and have high levels of customer satisfaction should reduce the need for support intervention. The iPad also enables students to perform a wide range of authentic tasks that would be transferable to a real business environment. Airplay is a significant feature of iOS devices that allow the wireless sharing of a screen image. Anyone in the class could send an image from their screen to an Apple TV device that was connected to the projector at the front of the room. This allowed for more dynamic discussions where anyone could easily show content to the whole group.

Which apps and Web 2.0 services are used as cognitive tools?

Significant investigation, testing and exploration have been performed by the researchers to find the most applicable suite of apps for use in the course. For practical reasons, and to reduce barriers, the researchers made the decision to only recommend the use of free apps and Web 2.0 services in the course. The following apps and Web 2.0 services have been introduced to the students gradually over the duration of the course:

iBooks: All course materials provided by the lecturer were provided in the iBook format. This format is unique to the iPad and requires the use of the free iBook app. The iBook format is an advanced eBook format that provides significant benefits over traditional printed texts. iBooks can include a variety of forms of multimedia and interactive elements such as video, Keynote presentations, quizzes, web-based feedback and polls. The lecturer developed a comprehensive set of iBooks to give grounding in each area of the course, and to provide the details of the authentic tasks to students.

Google Drive: Previously known as Google Docs, Google Drive is a free service provided by Google to allow the storage and sharing of files. It also allows user to create and collaborate on documents and spreadsheets on any device they like. This service was used extensively during the course as it enabled the student teams to work collaboratively on their authentic tasks and assessments.

Google Hangout: Google Hangout is a relatively recent service offered by Google that allows groups of users to "Hangout" and chat together, via text, audio or video communication. It is an excellent free tool for bringing people together. Through the course, students have used this tool extensively to support their teamwork and break down the physical barriers during times that they are unable to physically come together.

Mindmeister: Mindmeister is a web based collaborative mind mapping tool. It offers free accounts that allow up to three maps to be shared online at a time, or paid accounts with fewer restrictions. The students were encouraged to use the service through both a web browser interface and a free iPad app. The tool enabled students to work together on the same mind map, supporting their tasks both in and out of class sessions.

Wordpress: Wordpress is the preferred blogging platform for the course. Students were required to create and maintain a reflective blog, which chronicled their experiences and views throughout the course. Students created their blogs using the free, hosted wordpress.com service, which allowed them basic blogging functionality in their own personalised environment. The Wordpress platform offers user-friendly web browser based tools to create and manage blogs in addition to a powerful mobile app. Students made use of both methods during the course, and were free to choose which suited them best.

Aurasma: Aurasma is an augmented reality platform that layers electronic content over the top of real world content. Students made use of Aurasma to add value to their marketing posters, which they developed at the beginning of the course. A number of them also chose to use Aurasma later in the course at various stages, such as to create an interactive product list.

Prezi: Prezi is a web based collaborative presentation tool. It differs from traditional linear presentation tools such as PowerPoint and Keynote as it provides the user with a large open canvas and allows them to place content wherever they like. In addition to the web browser interface, many students made use of the free Prezi app in order to present their work.

Gantter: Gantter is a free web-based project management tool. It allows groups of users to work together on a gantt chart with similar features to the expensive Microsoft Project, which is the industry standard. Students were required to use this tool to plan their two report assignments, and some also used it for other non course-related tasks.

Microsoft Office: A significant portion of the course involved the use of the traditional business productivity suite Microsoft Office. During the course, students created a range of authentic business outputs in the form of posters, letters, reports, presentations, spreadsheets and databases. While the Office software was not available on the iPad at the time of the course, students found ways to integrate their work with the iPad through the other cognitive tools mentioned earlier.

Administrative Tools: Some students made use of note taking apps, such as *Evernote* and *Penultimate* to keep track of important thoughts and developments both in and out of class. These apps make it easy to collect, organize and share their notes, either through typed, handwritten or multimedia formats. Others recorded video using the built in camera app, which they then used for augmented reality, blog posts or as part of their presentations.

The research design

A design-based research (DBR) study is currently being conducted to explore how tablet computers can be used as cognitive tools to support and enhance learning in an authentic learning environment, in particular by investigating the affordances of the devices, design and implementation issues, and cognitive and affective outcomes. The research will be conducted guided by Reeves' (2006) model of DBR, including: an extensive literature review and exploration of the problem through discussion with colleagues within Business Departments and through an iPad Community of Practice; a re-imagined and re-designed Information Systems and Applications course; iterative implementations of the revised course; and the creation of design principles for 'Mobile Authentic Learning'. This course will continue to be used by the host organization and it can be used as a partial template for the development of other similar courses.

The study is currently in the data collection phases, including eight in-depth interviews with students after course completion. The results of these interviews will help shape future iterations of the project to further progress the capability of the iPad and its apps as cognitive tools to augment the student learning experience.

The theories underpinning cognitive tools have the potential to greatly improve the effectiveness of technology in education. Much of the use of technology devices in the past has revolved around learning *from* the technology (Kim & Reeves, 2007). This is a replication of the way educational resources such as textbooks, whiteboards and television traditionally have been used. Initial attempts at moving beyond the idea of learning *from* the technology have been criticized as they have focused on *how* to use the technology. Oppenheimer (1997) for example has likened these attempts to teaching "hammer" instead of teaching "carpentry". Computing devices, however, offer a much greater potential as cognitive tools for learners to learn *with*—in a considerably more powerful partnership between learner and tool. Most research into cognitive tools to date has focused on computers rather than more recent mobile devices. With the arrival of the iPad in 2010, the world of mobile devices has undergone significant change. Further studies such as the one outlined here will help to identify the means for these devices to be readily employed as powerful cognitive tools.

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Imagining the future of assessment: for evidence, for credit and for payment

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MOOCs are beginning to affect the business models of higher education providers by hastening the 'unbundling' of some of the central functions of higher education, particularly formal credit for learning and providing pathways to further study. This paper reports on Deakin University's work in this sphere in a newly launched MOOC, *Humanitarian Responses to 21st Century Disasters.* In this course, assessment has been 'flipped', so that instead of being examined, students are invited to demonstrate their achievements against learning outcomes and achieve peer credit badges that can be shared on LinkedIn and Facebook. If they choose, up to 100 students can also pay $495 for formal assessment. Those whose learning evidence is assessed as meeting all the requirements will be granted the equivalent of one subject credit when applying for entry to particular degree courses. This developing model may extend the benefits of higher education.

Keywords: Badging, assessment, evidencing achievement, MOOCs, 'Unbundling' university functions

During 2012 and 2013, the headlines in higher education news have kept reminding us that we live in a disrupted environment, one where MOOCs have triggered enormous change in learning (Coaldrake & Stedman ; IBIS Capital; Norton, Sonnemann, & McGannon). Not everyone agrees: some claim that this is just massification of thirty years of endeavor in online learning and its predecessors (Matt & Fernandez). Regardless of our thoughts about MOOCs, the quality of the learning they offer, and their longevity, the real change is occurring in the business models that underpin higher education providers. Free learning resources have been available for years through Open Courseware and iTunes U—and institutions such as Open University have found them a great channel for recruiting paying students (Attwood). MOOCs have begun to blur this 'openness', as startups and institutions attempt to offer some courses for free, some for payment, and some as pathways to paying students. In the United States, Coursera is moving to become a third party provider, onselling the courseware of Ivy League universities to colleges and others. VentureLab offers interactivity, proclaiming itself to be 'the only online learning platform that provides a connected, effective and engaging learning environment for students' (https://venture-lab.org/about). Udacity is offering MOOCs for credit, in association with Georgia Tech (Rivard). In Australia, some universities have joined the startups (Coursera and EdX); Monash University has joined FutureLearn. Some have carved their own path: Open Universities Australia has set up its own platform (Open2Study) which offers assessment and badges and pathways to courses; the University of New England (UNE) has created its own platform (UNEOpen) and enables MOOC completers to take a challenge exam for $495.

A case study in flipped assessment

This paper reports on a similar project: Deakin University has created DeakinConnect as a new open learning space. The first open course offered in DeakinConnect, *Humanitarian Responses to 21st Century Disasters,* commenced in July 2013. It is designed as a 'conventional' MOOC, in that it is free and open to all comers, but it also allows interested students to provide evidence of their learning. On completion of the course, successful participants can demonstrate their achievements in the following learning outcomes:

- Discipline-specific knowledge and capabilities: the history of the humanitarian sector; the principles and practices that inform responses to natural and man-made disasters and emergencies; key humanitarian organisations, individuals and their roles; and the complexities and ethical challenges of disaster and emergency responses.
- Communication skills: using oral, written and interpersonal communication to inform, motivate and effect change
- Critical thinking: evaluating information using critical and analytical thinking and judgment
- Digital literacy: using technologies to find, use and disseminate information
- Global citizenship: engaging ethically and productively in the professional context and with diverse communities and cultures in a global context

These are five of Deakin's eight Graduate Learning Outcomes and, as we will argue, students are invited to think about how they might evidence them rather than being challenged to do so through traditional testing and measuring.

The DeakinConnect platform, then, enables participants to:

- **Learn** by accessing resources such as expert commentary and interviews, and by testing response strategies in Lolesia, an imaginary country in South East Asia, suffering from decades of economic stagnation and oppressive rule
- **Engage** agree, challenge or question others' ideas
- **Network** with humanitarians and peers from across the globe
- **Evidence** their knowledge and capabilities in an online portfolio
- **Credit**: give and receive peer credit and feedback on others' learning. In addition up to 100 participants will be able to apply to earn credit towards a Deakin University qualification in this field for $495.

This work is central to Deakin's mission. Deakin University has chosen to offer this open course exactly because it seeks to drive the digital frontier and offer brilliant education "where students are and where they want to go" through personal, engaging and relevant learning experiences (Oliver, 2013a). DeakinConnect is a prototype of the type of cloud learning space that enables learners to have a 'flipped' assessment experience. This is analogous to the 'flipped classroom' model in which transmissible material is prepared outside the classroom, and the classroom experience is given over to interactive work (King). Although MOOC participants are under no obligation to complete any assessments, and most will not do so, these participants may be interested to see the learning outcomes. DeakinConnect sets out learning outcomes, but onus is on the learner to persuade rather than the examiner to probe for evidence that the learning outcomes have been achieved, in keeping with suggested practice in judging performance in broader graduate attributes (Yorke, 2008). Instead of asking students questions, DeakinConnect offers assessment opportunities that are intended to prompt the learner to create and curate rich digital evidence of learning. Participants are invited to create up to six 'learning exhibits' that specifically demonstrate their capabilities. DeakinConnect also invites students to assess each other's work, explicitly testing the viability of peer assessment and feedback, using digital badging, a technology which has been gaining attention in recent years (Raths; The Mozilla Foundation and Peer 2 Peer University; Young).

Re-imagining credit

Learning achievements are often accompanied by credit—informal credit from peers, friends, family and colleagues; and formal credit from educational institutions. The DeakinConnect course is open and free, and in addition, up to 100 participants will have the opportunity to apply to have their learning formally assessed (for a fee of AUS$495) for entry into and credit towards a Deakin qualification. The formal assessment process will be based on FOUR learning exhibits: two learning exhibits from DeakinConnect; a formal research paper; a 20-minute interview. Those whose learning evidence is assessed as meeting all the requirements will be granted one credit point when applying for entry into Deakin University's Graduate Certificate of International and

Community Development or Master of International and Community Development (additional entry requirements apply to both degrees).

In DeakinConnect, then, participants can both earn peer credit, and also use their learning exhibits to earn formal credit towards entry into a Deakin University qualification. When participants share their learning exhibits, peers can award credit signifying that they believe the exhibit shows mastery of learning outcomes at or beyond agreed standards. Alternatively, peers are guided to provide constructive feedback on how participants can improve their learning exhibits to meet or exceed the standard. When peers award credit, participants receive a DeakinConnect Peer Credit badge that can be shared on Facebook or LinkedIn.

Successful completion of all the assessment means gaining credit for the equivalent of the first unit of an eight unit Graduate Diploma or a 16 unit Master degree (the participant pays $495 instead of in excess of $2000—a substantial saving). It is difficult to foresee how this might play out in the market, but using a low-cost but high-value and fully accredited learning experience to cut some of the costs of a full-price degree is beginning to gain some popularity among students. This is particularly the case in the United States, where the cost of degrees is soaring (Selingo). Costs at public universities are rising (by 8.3 % last year, the biggest jump on record: Simon), and at the same time, as Selingo puts it 'the unbundled alternatives are improving' (Selingo, 66). That is, teaching and online delivery are being separated from the stratospherically expensive research, athletics, and 'party' functions (Armstrong & Hamilton) that make up the modern US residential university. There seems to be a slowly growing tendency for some students to take some of their degree at much cheaper institution: community colleges, institutions close to the family home, and so on, thus making substantial savings on the overall student loan they build up (Selingo, 124).

The Australian context is certainly different, and currently much less expensive. But costs are rising here too, and it will be interesting to see how attractive a significant cut in overall costs might prove to be. MOOCs have triggered an exploration of new business models, and are testing the market to see what students will pay for. Essentially, those offered by UNE and Deakin are about offering a loss leader as a pathway to recruiting fee-paying students. Interestingly, the market catches on very quickly. When this idea was first made public, comments from readers focused on "the cost of this to the university"—that is, "how can a university charge $495 for an exam, when the marker is barely paid $20 an hour" (Oliver, 2013b). Universities have probably seen themselves as selling many things to their students: an experience as an undergraduate or postgraduate, a branded degree, a career connection, student satisfaction and extra support services, convenience and reliability. MOOCs are show that universities in fact sell credit: credit for learning, whether for separate units or whole degrees, or even a certificate of completion is portable currency—students can take their certificate of completion or credit to a competitor and ask for recognition of prior learning. This is already happening as a consequence of the MOOCs. It is part of the 'great unbundling' that is already occurring , and students may very soon ask us to flip this model: they may well to want to do a challenge exam only ($495) instead of the 12 week unit with all its classes and experiences and assessments, and price tag of $2000 (simple credentialing of this sort was, after all, initially the role of the University College London in the nineteenth century). Students may also want to pay more basic fees, then pay as they go if and when they wish to access one of the service that is now for bundled with the whole fee, such as counseling, careers, subsidised child care, and so on.

Conclusion:

Just how the rise of MOOCs might change the global higher education landscape is yet to be seen, but there is evidence that one outcome may be exactly this unbundling of functions. If this comes about, we may well see the best of both worlds. The expensive on-campus, now usually blended, learning experience-- with all the bells and whistles of ancillary services -- would be maintained as that prized transition-to-maturity experience for undergraduates who are usually relatively young and relatively middle-class. At the same time, new models of assessment for credit, such as we are piloting in DeakinConnect, could also extend the benefits of learning and the acquisition of credentials to those non-traditional students who may previously have lacked the time or the money to undertake traditional 'on-campus' or 'off-campus' study—even those terms need revisiting as we learn and teach at the digital frontier.

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The Greek flip: old language, online learning

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The flipped classroom has generated much enthusiasm as the future of education. Past research has shown personal support from a tutor as highly effective, but uneconomical. Might flipped formats be a solution to this economic problem? This paper reports on a flipped design for teaching ancient Greek in a theological college. Students learnt the basic content through online videos and activities, and then attended a two-week intensive to interact with faculty and peers. Students were very satisfied with the online resource and agreed that it had helped them prepare to learn Greek, although they were keen to keep the personal interaction with peers and teachers. They used it heavily for an extended period of time. The proportion of students failing or achieving a simple pass decreased, although more data is required to confirm the impact on marks. Overall, the adoption of a flipped format has been validated.

Keywords: flipped classroom, blended learning, language learning

Introduction and Context

The "flipped classroom" has generated much enthusiasm in the last few years, with claims of benefits such as lower failure rates, greater engagement, teachers better in tune with students' progress, and more effective targeted support (Thompson, 2011; Roscorla, 2011; The Economist, 2011). Flipping a course involves providing the basic content to be learnt as online media (typically video tutorials) which students can cover individually at home, while exercises and projects are done in class together with the teacher and peers. Sal Khan's TED presentation on how his video tutorials have been used in classrooms has been a prominent catalyst (Khan, 2011a). Khan has moved from tutoring a cousin on his spare time to founding the Khan Academy, with financial help from the Gates' Foundation (Thompson, 2011). TED has formed a platform to allow teachers to use their videos within a flipped format (ed.ted.com), in which Sal Khan is an adviser.

Indeed, the flipped classroom has been widely touted as the future of education. "Spend a few minutes playing with the Khan Academy dashboard of a class in Los Altos, and you see a vision of the future", The Economist (2011) notes. After Sal Khan's popular TED presentation on using tutorial videos to reinvent education, Bill Gates commented "I think you just got a glimpse of the future of education" (Khan, 2011a). Khan's vision of education in 2060 involves a change in the classroom's role, from large group lectures and a fixed "seat time" to an active and creative process with consistent high standards of achievement (Khan, 2011b). It has quickly gained prominence within a context of calls for education to be 'disrupted' and expectations of significant innovation and change (Christensen, et al., 2010).

The future may become clearer from the perspective of the past. Close to thirty years ago, about the time of the first ASCILITE conference, Bloom (1984) published a report on the relative effectiveness of various techniques to improve the teaching-learning process over the traditional large group lecture. One-to-one tutoring was the clear winner, taking the average student two standard deviations higher than what he or she would have been under conventional conditions. Yet, he saw universal one-to-one tutoring as unfeasible and dubbed the challenge to reproduce this impact in an affordable and scalable format *the two sigma problem*:

> The tutoring process demonstrates that most of the students do have potential to reach this high

> level of learning. I believe an important task of research and instruction is to seek ways of accomplishing this under more practical and realistic conditions than the one-to-one tutoring, which is too costly for most societies to bear on a large scale. This is the '2 sigma' problem. Can researchers and teachers devise teaching-learning conditions that will enable the majority of students under group instruction to attain levels of achievement that can at present be reached only under good tutoring conditions?

Notably, the block to significantly improved education is not a *theoretical* one, but an *economic* one. *What* will achieve improved learning is known; *how* this can be done in an affordable way isn't. This clarifies the potential role of technology, since its impact is essentially an economic one through an increase in productivity: increased outputs for lower inputs. In flipped formats, technology makes it feasible to inform teachers of students' progress and needs, while creating the space for personal and targeted support. As Khan puts it, "by removing the one-size-fits-all lecture from the classroom and letting students have a self-paced lecture at home, and then when you go to the classroom, letting them do work, having the teacher walk around, having the peers actually be able to interact with each other, these teachers have used technology to humanize the classroom" (2011a). Might the flipped classroom thus solve the two sigma problem? Further, flipped formats raise several questions:

- How would students feel about such a flipped format?
- How would they value the flexibility of the self-guided online element relative to the interaction of the live sessions?
- To what extent and how would students use a self-guided online resource?
- What would be the impact on marks, if any?

This paper reports on the implementation and results of a 'flipped classroom' design for the learning of an ancient language in a theological college, with a specific focus on the above questions. Moore Theological College, one of Australia's oldest tertiary institutions, is a leading trainer of Anglican ministers and offers diplomas, graduate, and post-graduate degrees. One of its distinctives is a focus on the original biblical languages, namely Hebrew and Koiné Greek. Students study Greek during their first year of the Bachelor degrees. Understandably, the learning of these ancient languages is a source of anxiety for many students. Traditionally, first year students have done a two week summer intensive in the first half of February known as 'Greek Weeks' before the start of their course to gain a foundation of the language. It has also functioned as an orientation period. By the end of this intensive students are able to start translating the gospel of Mark from the original Greek. There is no formal summative assessment for the intensive. Once the academic year starts, students complete a Greek subject in each semester, namely Greek 1A (8 credit points) and Greek 1B (4 credit points).

Development

During 2010 the college embarked on the development of an online resource designed to introduce incoming students to Greek basics and allay their anxieties. A freelance media producer was hired to assist in script writing as well as recording and editing the video. The team was made up of the lecturer as content expert, a project manager, media specialist, and the author as an educational technologist.

The team faced two pivotal questions. Firstly, should the videos be produced by simply recording the Greek Week lectures or should scripted video tutorials be produced specifically for this exercise? It was decided to produce scripted video tutorials, despite the much higher cost and effort involved. Secondly, how should this online resource relate to the Greek Weeks sessions? The team eventually came to see this resource as a supplement to the Greek Weeks rather than a replacement.

Given this was a fairly new area to the college, a pilot was run in early 2011 with a subset of introductory content and little detailed Greek coverage. This trial confirmed both the OGI's helpfulness and students' desire to attend a live session. The team then proceeded to produce the bulk of the videos and online activities. In June 2011 the team watched Salman Khan's TED presentation on using video to reinvent education (Khan, 2011a), which was further confirmation of the design decisions made. The full resource was launched in late 2011 for the 2012 cohort. It was made available to 2013 students from September 2012, as their enrolment was confirmed, giving them more time to prepare. Students are notified of their access details via email, once their enrolment in the course is confirmed. Although students are strongly encouraged to complete it, no formal assessment is attached to it.

The resource, named the Online Greek Intensive (OGI), is a set of 46 video tutorials, online activities, and digital resources. It was implemented within the Moodle LMS. An introduction section includes a set of videos such as a personal introduction from the lecturer, an interview with the college principal on the value of learning Greek, and comments from previous students on their experiences learning Greek. Students are asked to introduce themselves in a discussion forum, with their plans, hopes and anxieties. A survey gathers their knowledge and feelings. After a brief introduction to the history of the language and advise on how to use the resource, the content dives into detail: the Greek alphabet, common letter combinations, accents, nouns, verbs, tense-forms, and their parsing. The videos are typically about five minutes long. Most videos are paired with an online activity implemented as a Moodle quiz to let students practice the concepts covered. For example, some quizzes help students practice correct pronunciation (Figure 1) via audio media while others help in parsing verbs (Figure 2). The videos and activities are supplemented by a 58-page manual and a set of ten vocabulary lists as MP3 audio files that students can listen to and practice their pronunciation at their convenience away from their computer.

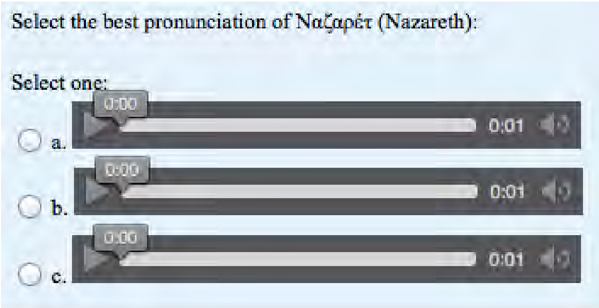

Figure 1: audio-based quiz question

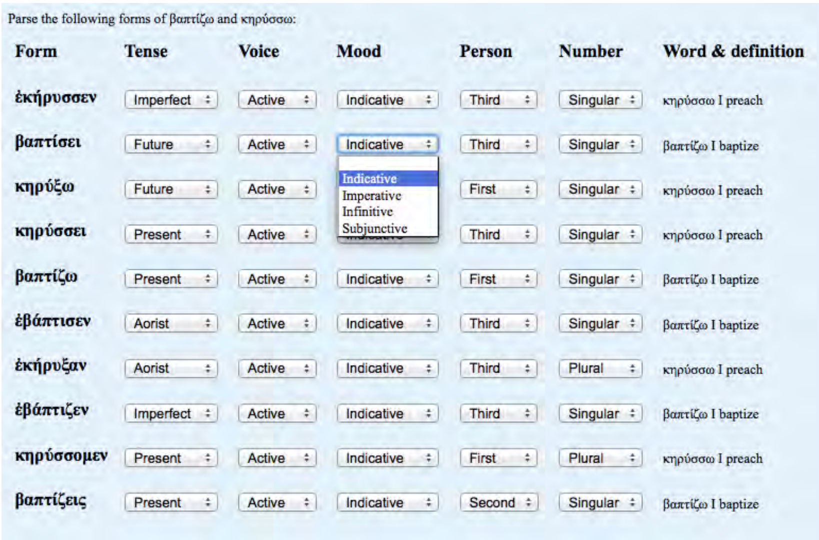

Figure 2: verb parsing activity

Satisfaction and attitudes

Students were asked to complete a survey on their satisfaction and concerns, with 30 students in the 2012 cohort opting to complete it. Students in the 2011 and 2013 cohorts also completed it.

Respondents expressed their overall satisfaction on a five-point scale, with one as ‘very dissatisfied’ and five as ‘very satisfied’. Seven were ‘satisfied’ and 23 were ‘very satisfied’, with a mean of 4.77. This very high level of satisfaction was repeated in the 2013 cohort, with a 4.75 mean. The 2011 cohort, who only had access to the limited OGI pilot, was lower but still fairly high.

Table 1: satisfaction levels

Satisfaction	2011	2012	2013
1-Very dissatisfied	0	0	0
2	0	0	0
3	3	0	0
4	4	7	5

5-Very satisfied	6	23	15
Mean	4.23	4.77	4.75
Responses	13	30	20

Students were asked for their level of agreement on a five-point scale to the following statement: “This online resource helped me feel better about learning and using Greek”. There was strong agreement to the OGI’s helpfulness in the 2012 and 2013 cohorts. As in overall satisfaction, agreement in the 2011 cohort, who did not have access to the full videos and exercises, was less strong.

Table 1: Agreement with “This online resource helped me feel better about learning and using Greek”

Agreement	**2011**	**2012**	**2013**
1-Disagree strongly	0	0	0
2	1	1	0
3	5	2	1
4	5	9	7
5-Agree strongly	2	18	12
Mean	3.62	4.47	4.55
Responses	13	30	20

Students were asked what concerns, if any, they had regarding this online resource. Figure 3 shows lack of personal contact with both a teacher and peers as the main concerns. This is particularly the case in the 2011 cohort, perhaps due to a lack of clarity in that early pilot stage on how the OGI would relate to the intensive. As the complete OGI was introduced in 2012, concerns about losing personal contact decreased while anxiety over sufficient Internet access increased. This may be due to a clearer role of the OGI as a supplement towards an intensive and more videos respectively.

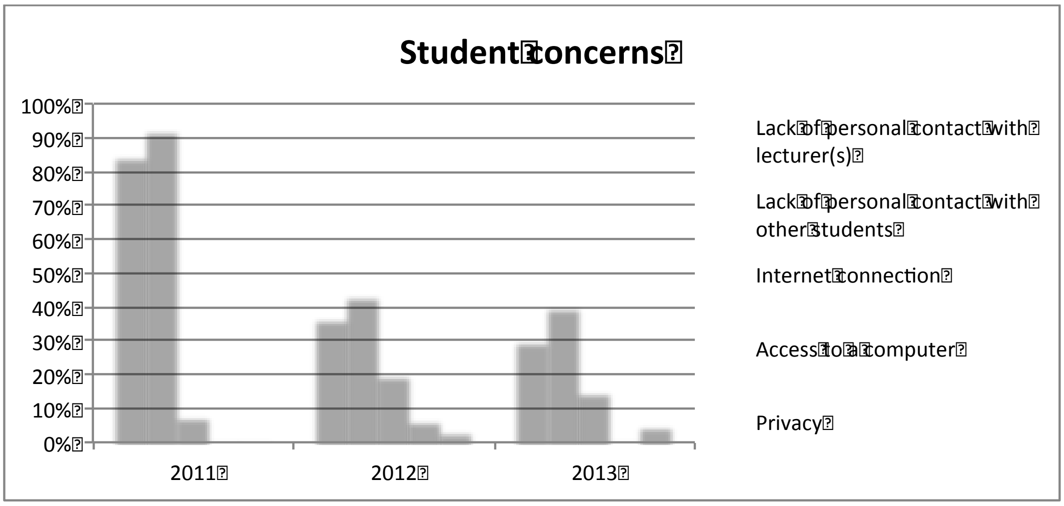

Figure 3: Percentage of respondents nominating each concern by cohort

Lastly, students were asked what, if anything, hindered their use of the OGI. Lack of time was the only significant issue raised, with seven (23%) in the 2012 cohort and nine (45%) in the 2013 cohort nominating it.

Table 2: Factors hindering use of OGI

Factor	2011	2012	2013
None; I did use it significantly	10	14	15
Didn't have time	0	7	9
Didn't see the value of it	0	1	0
I had problems accessing it and gave up	0	1	0
I lack the technical skills or confidence	2	0	0
I lack sufficent access to a computer	0	0	0
I lack sufficient access to the internet	0	1	0
I'm concerned about privacy	0	0	0
Other	3	7	2
Responses	13	30	20

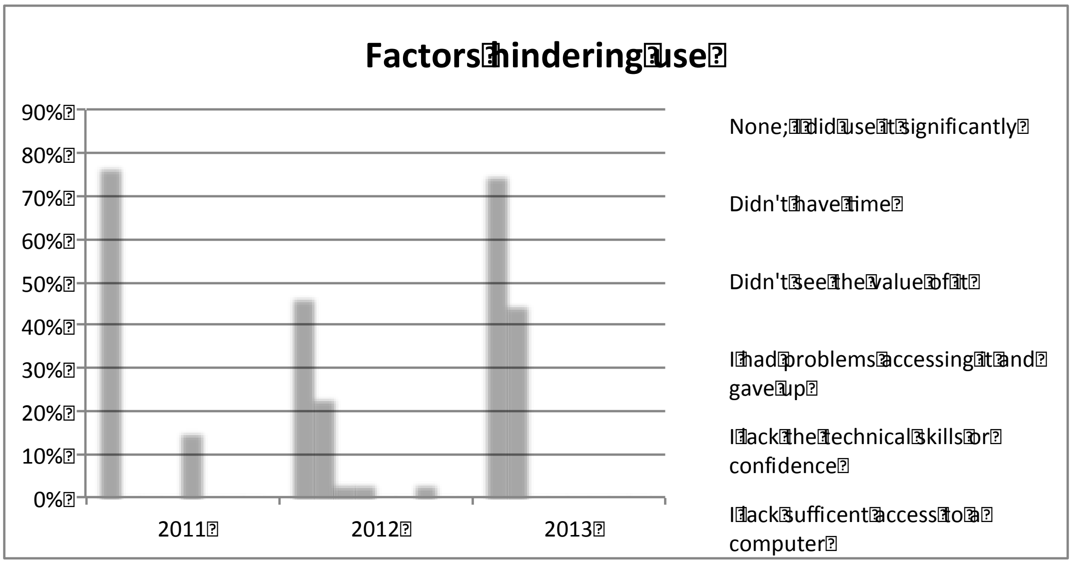

Figure 4: Factors hindering use of the OGI by cohort

Student engagement

The vast majority (79 of 85) of 2012 students used the OGI to some extent. As illustrated in Figure 5, activity peaked in February, when the Greek Weeks are held. Indeed, it peaked the days just prior to the intensive. It was still heavily used in March, as their formal Greek study started in earnest, and continued until May, three months after their intensive. Exams are held in June, with a supplementary available for students who fail. The uptick in July may be due to students who have failed revising before a supplementary in that month.

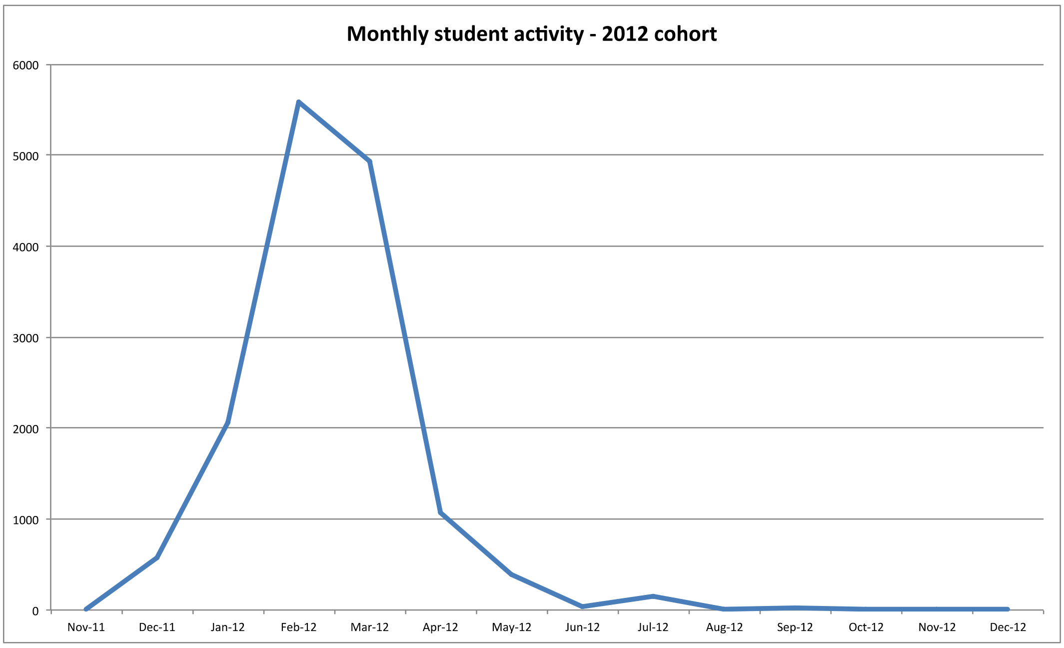

Figure 5: Monthly Moodle actions, 2012 cohort

Figure 6 compares activity between the 2012 and 2013 cohorts on a monthly basis, with the month number relative to February when the intensive was held. The 2013 students were emailed access as they accepted their offers into the course, starting from September 2012. The 2012 cohort, on the other hand, only received access in late 2011. It is evident the 2013 cohort started using the OGI as they received access, suggesting they valued the opportunity to start learning Greek up to four months before the start of their course. The pattern of continued use beyond the intensive is also reflected with this cohort.

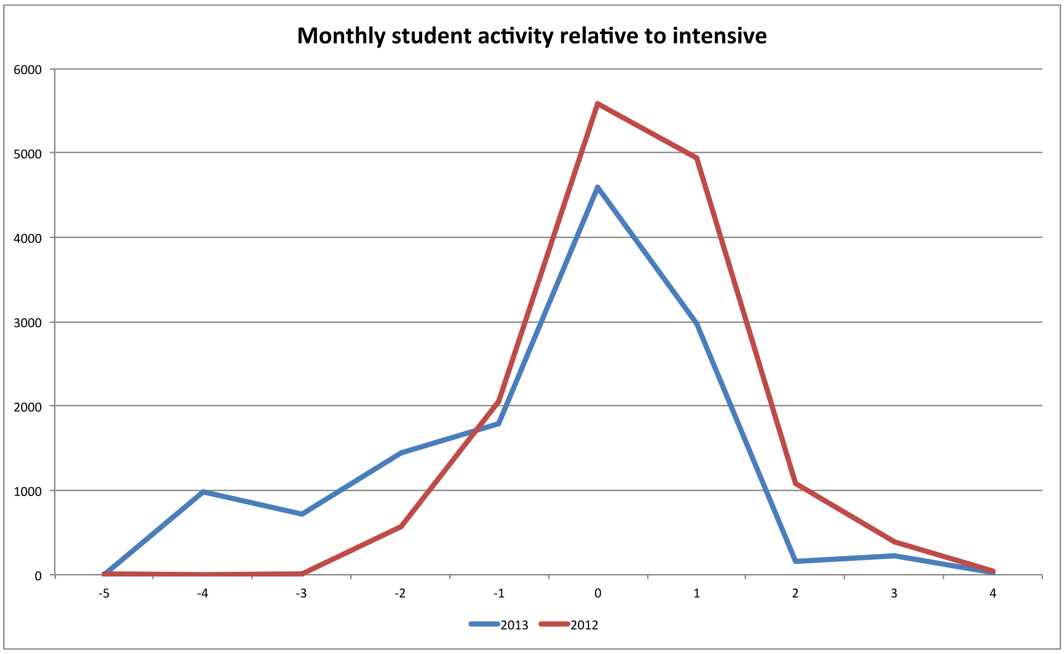

Figure 6: Monthly Moodle actions relative to intensive (2012 and 2013 cohorts)

Exam marks

The full OGI was introduced to the incoming 2012 cohort. Within this cohort, 79 used the OGI and six did not. ‘OGI use’ is determined by any student actions in the system between 1/12/2011 and 31/5/2012. These numbers exclude 18 students who attended a special evening format of the Greek Weeks to avoid potentially extraneous factors. For the 2013 cohort, 93 used the OGI between 1/6/2012 and 31/5/2013, and seven did not. Unless otherwise stated, marks reflect the mid-year exam since it is assumed the OGI would have the most impact on it.

Results are analysed in three broad ways:

- Compare marks in the 2012 and 2013 cohorts between those who used the OGI and those who did not.
- Compare marks from the 2012 and 2013 cohorts with previous ones.
- Correlate the number of quiz attempts with exam marks.

Students who used the OGI achieved higher mean marks than those who did not, with a difference of up to ten percentage points across three exam samples:

Table 3: Mean marks for 2012 and 2013 cohorts, mid and end of year exam

Exam	OGI not used	OGI used	Overall
12_1A	75.65	83.09	82.56
12_1B	64.64	75.33	74.43
13_1A	70.91	81.76	80.23
Overall	70.34	80.16	79.17

Given very few students did not use the OGI, it is worthwhile to compare all OGI users in the 2012 and 2013 cohorts with the 2010 and 2011 cohorts, who did not have access to the complete OGI. Prior to 2010 Greek was taught in a different format, with a single exam at the end of the year, and thus these cohorts have been excluded. Figure 7 shows that 2012 and 2013 students had a higher 1A mean mark than 2011, but not 2010. 2012 students did achieve a 1B mean mark higher than both previous cohorts.

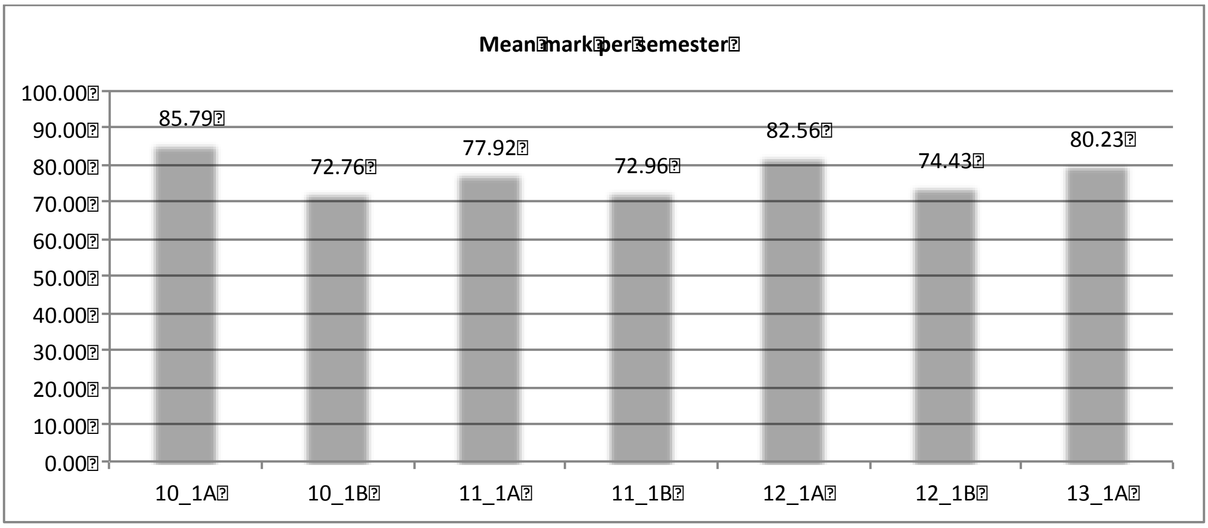

Figure 7: Mean marks compared to pre-OGI cohorts

Beyond simple means, the 2012 and 2013 cohorts' grades distribution for the first semester exam are noteworthy. The percentage of students who failed decreased by more than half from the 2010 and 2011 cohorts, while the percentage of those who achieved a simple pass also decreased. The proportion of students who achieved an Honours award with Class 2B or 1 increased.

Table 4: Percentage of students per grade, 2010 and 2011 cohort 1A exam vs 2012 1A OGI users

	N	Fail	Pass	Hons 2B	Hons 2A	Hons 1
10, 11 1A	172	6.40%	11.63%	5.23%	14.53%	62.21%
12 and 13 1A, OGI users	164	2.44%	10.98%	8.54%	12.20%	65.85%

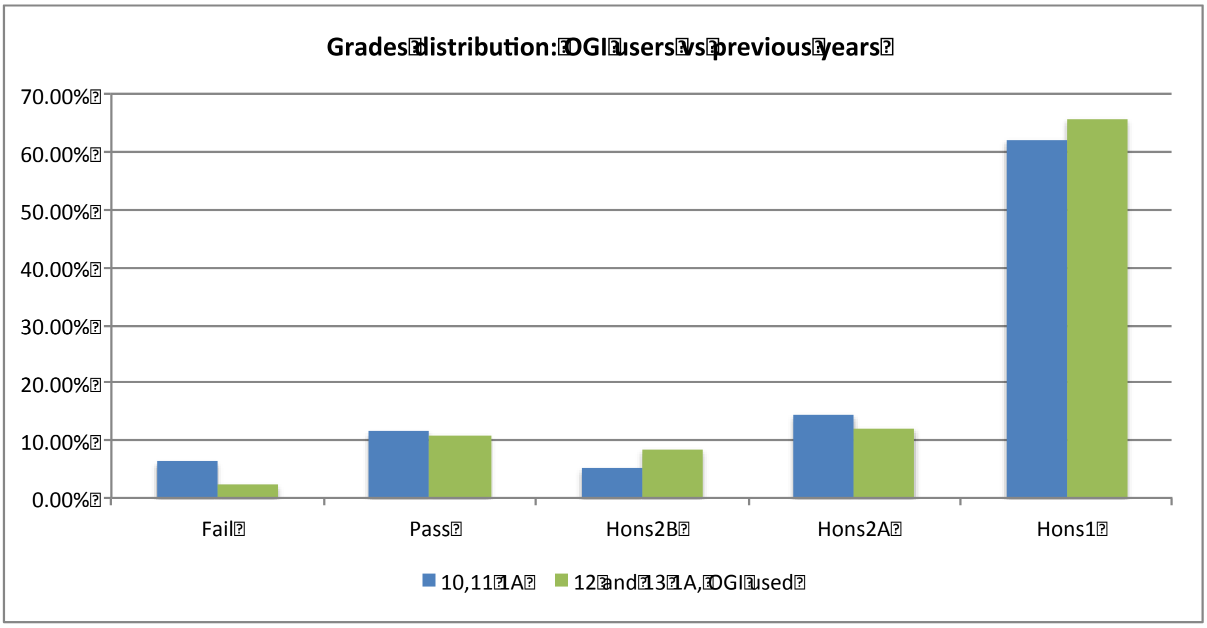

Figure 8: Percentage of students per grade

Lastly, there is a correlation of r=0.206 between the number of quiz attempts and the 1A exam mark. This is a positive but weak correlation, so no firm conclusions can be made on the direct impact of the online resource on marks.

Discussion and Conclusion

This paper has described the implementation of a flipped classroom format for a Greek orientation intensive and reported data on how students felt about the resource, what they did with it, and how they performed in their exams.

Students were clearly very satisfied with the OGI, and felt it was a significant help in getting ready to learn Greek. The sustained increase in satisfaction and belief in its helpfulness once the full OGI was introduced is evidence that students appreciated the detailed Greek exercises, rather than just the overall introduction videos. This high satisfaction level together with students' main concern of losing personal interaction with teachers and peers are evidence that they do not see the OGI as a *replacement* to the classroom. Rather, they want *both*.

Students' satisfaction is underlined by their heavy use of the resource. The early start to activity suggests students saw it as helpful as well as addressing common anxieties. The peak just before and during the intensive suggests students understood the close connection between the online resource and the Greek Weeks. The continued activity well beyond the intensive suggests it was a helpful resource in their ongoing study, and potentially in their revision for the exam.

There is some evidence that the cohorts with access to the OGI achieved higher marks than previous cohorts over the whole first year, with lower proportions of students either failing or achieving a simple pass. However, given the relatively small samples, this finding can be confirmed by future cohorts. The lack of strong correlation between OGI activity levels and marks may be caused by a combination of struggling students using it more to aid their learning and conscientious students completing it thoroughly even though they would have done well regardless. More probably, it may not be the OGI itself which is the critical factor, but the added personal interaction and attention during the intensive, made possible by the reduced need to spend time covering basic content.

There are some noteworthy contrasts between the OGI and the typical flipped classroom. Firstly, the videos and online material are used to take the presentation of core content not just outside the *class*, but outside the *course*. This introduces a novel complication, as the line in students' mind between admission, learning, and assessment may blur. Students were given access after their acceptance and were assured the OGI was neither mandatory nor formally assessed. Nevertheless, the team was mindful that some students may have still felt anxious that it might affect their entry into the course. Secondly, the videos were professionally produced to high quality after much effort in scripting, coaching, and recording. This is different to the unscripted and unedited talk to a webcam that a teacher or Khan Academy might produce. Despite the clear benefits of fast and cheap video production, there were good reasons to invest in a professional production. The OGI does more than present content. It also serves as an initial orientation process, seeking to *convince* students of the value of learning Greek while also *reassuring* them in their anxiety. This *affective dimension* called on a more sophisticated use of video media, requiring professional assistance. Thirdly, language learning may not be seen as the obvious subject matter to flip given the need for continual and personal feedback on pronunciation. On the other hand, learning Greek requires much drilling and memorising gendered nouns and verb conjugations, which is in turn well suited for self-guided online learning. Moreover, perfect pronunciation is less critical in learning an ancient language for exegesis. Lastly, video media is typically used to present content in flipped formats, but the OGI included content such as vocabularies in audio-only format. This was appropriate as the content was aural in nature and facilitated practice while doing other tasks.

The development project yielded several lessons. The risk of failure involved in developing such a complex and novel resource was considerable. The paradoxical solution was to fail quickly, cheaply, and safely through the pilot. While scientists can see far because they stand on the shoulders of giants, innovators can walk through the foggy quicksands of uncertainty because they step on the corpses of failures. The pilot was designed to flush out problems by 'failing safely', minimizing risk and disruption to students. As it turned out, it confirmed students' enthusiasm and engagement with the OGI, their valuing of the personal contact in the intensive, and the soundness of the technical infrastructure. This was welcomed by a college without much experience developing educational technologies. Indeed, it answered for the team the questions about the project that the OGI aims to answer for students about learning Greek: is it worthwhile? Is it possible? Moreover, the value of a multidisciplinary team was evident. It was led by a teacher with clear learning goals but who was flexible regarding means, assisted by a media specialist able to coach the teacher in scripting and performing to camera, and a technologist able to bring together the various resources. Wise media selection, producing a portfolio of video, audio, and text formats, was also important. One potential pitfall in flipping a classroom is to be blind to the value of activities that happen naturally but *incidentally* during class. The team was aware that the Greek Weeks also performed a very important role of orientation, as students' first educational experience at college. This then had to be *formalised* to an extent to ensure it happened.

In conclusion, the high satisfaction and engagement levels have validated the decision to adopt a flipped format rather than attempt to 'replace' the Greek Weeks with recorded lectures. This would likely have resulted in students unhappy with lower quality videos and anxious at the loss of personal interaction with a teacher and peers. With the flipped format, students already have a foundational understanding of the content at the start of the Greek Weeks. At the same time, the teacher already has an understanding of students' progress and needs via OGI analytics. He can then adapt the agenda of the Greek Weeks to suit these and identify students that need to attend a remedial class. Students were very satisfied with the OGI and believed strongly that it helped them. They used it significantly over an extended period of time, and it probably reduced the proportion of students who failed or achieved a simple pass. The dream of a future way to learn a language from the distant past has already borne fruit.

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Gamification of Tertiary Courses: An Exploratory Study of Learning and Engagement

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Abstract:
'Gamification' is the implementation of game elements into non-game settings. In education, the purpose of gamification is to increase student engagement and motivation through the introduction of game elements such as leaderboards, badges and levels. Currently there is limited research into gamification in education and much of the research has focused on young children and 'play' or the implementation of gaming into classes, often technology based classes. This study explores the effectiveness of gamification in tertiary management education which may have implications for a wide range of tertiary education fields and identifies areas for further research.

Keywords: Gamification, management, student engagement, learning principles, motivation, education.

Introduction

Gamification involves incorporating game elements and game mechanics to non-game settings (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). One of the main aims of gamification is to increase engagement and motivation (see Domínguez et al., 2013; Simões, Redondo, & Vilas, 2013) Gamification is used in a range of settings including businesses which use game elements to engage consumers in their advertising (Terlutter & Capella, 2013) and loyalty programs (Huotari & Hamari, 2012). These elements may include scoreboards or experience points (xp) to track progress towards goals, badges to reward achievements, and leaderboards to compare progress with peers. Gamification also become an important element in the design of many software applications (Zichermann & Cunningham, 2011) including eLearning platforms (see Hilton, 2013; Muntean, 2011; Simões et al., 2013).

To experiment with principles of gamification, a trial was conducted with US American study abroad students at a Sydney study centre. During a course on cross-cultural communication students were encouraged to undertake optional experiential learning activities that were not assessed. The game element of a leaderboard was used to encourage students to undertake these extracurricular activities outside of class which were aligned with learning outcomes for the course. The extracurricular nature of the activities and voluntary participation reinforced their learning as "at-home digital game-play provides many opportunities for autonomous learning through explorations that promote cycles of theory-building, testing, and reflection, in ever increasing levels of complexity" (Nolan & McBride, 2011, p. 5). A leaderboard was useful for creating a social component and motivating through "bragging rights and social capital to the individuals who achieved the high scores." (Kapp, 2012, p. 34) Students self-reported their achievements and earned experience points commensurate with the degree of complexity of the experiential task.

Literature Review

Gamification and game-based learning

As gamification is an emerging field, there is limited literature on it. However, there is ample literature on using games in learning. Using game mechanics in non-gaming scenarios has been shown to "motivate individuals to attain personal goals, solve communal problems, and direct systemic activity" (DuBravac, 2012, p. 68).

For education, gamification offers the potential for greater student engagement and motivation (Simões et al., 2013) in classroom and online settings. Gamification allows instructors to "situate learners in authentic environments in which they can practice their skills and gain immediate feedback on progress and accomplishments, earn recognition for doing well, and feel good for overcoming a challenge." (Kapp, 2012, p. 22). Using games in learning however is not new (Muntean, 2011) and gamification elements may not need to be totally derived from video games but also playground games or board games (Glover, 2013). What is relatively new is a wave of scholarly and university administrator interest that has raised the profile of gamification (Simões et al., 2013). This interest may lead to new resources and technological improvements allowing further experimentation and implementation of 'gamified' courses.

Intrinsic motivation and goal theory

Intrinsic motivation can increase the enjoyment, performance and persistence of students' learning (Cordova & Lepper, 1996; Mills & Blankstein, 2000). This study explores whether the implementation of gamification increases student engagement and motivation in the tertiary environment and the results can be related to a range of motivational theories. The use of a leaderboard and its influence on students' motivation may be explained by goal setting theory (Ma, Jain, & Oikonomou, 2011, p. 409). Given that students have the choice over which activities to perform and when, gamification may also link to both performance and mastery orientation (Ames & Archer, 1988; Pintrich, 2003). This could be an area that could be explored by further research.

Research Methods

This exploratory research was conducted with 21 US American Management students in a Cross-Cultural Communication class. Students were given a list of experiential activities which could earn them xp and a leaderboard was formed. The experiment was designed to see if the xp and leaderboard elements of gamification would motivate students to go beyond the required activities and how the implementation of gamification influenced student engagement and learning. Participation in the gamification element of class as well as completing the surveys was voluntary and the surveys were anonymous.

Students were surveyed after four weeks of classes (three and a half hour classes held once per week) prior to the implementation of gamification. They were then surveyed again after a further four weeks with the gamification elements of xp and a leaderboard in place. The quantitative survey was developed utilizing a Likert scale to measure student engagement. This is consistent with other research in the area of engagement and learning (Kuh, 2003; Leithwood & Jantzi, 1999; Ma et al., 2011; Meece, Blumenfeld, & Hoyle, 1988; Shernoff, Csikszentmihalyi, Shneider, & Shernoff, 2003).

This research was based on 'low tech' mechanisms of gaining xp and a leaderboard function. This was deliberate because "most education and training does not require this level of fidelity as skills training is not the most typical instructional outcome. Instead, the most common course objective is transference of knowledge." (Ma et al., 2011, p. 399). Statistical analysis was then performed in order to compare the two surveys which were paired by students.

Table 1: Sample activities and assigned 'xp'

Activity	xp
Learnt "thank you" in another language	1000
Talked about a cultural experience in class	1000
Watched a documentary about another culture	1500
Added an International 'leader' to your social network	1500
Participated in Harmony Month	1500
Write a blog about your Australian experiences	2000
Write at least 3 journal or diary entries reflecting on your Australian experience	2000
Taken a tour of the Auburn Mosque	2000
Volunteer to do a 4 minute presentation on another culture in class	2000

Results

Preliminary results demonstrated that students were actively participating in the experiential and non-assessable activities in order to gain xp points and a position on the leaderboard. The leaderboard ranged from 2300 xps to 60,000 xps which demonstrated that every student in the class was motivated to participate.

A paired t-test analysis was conducted to test for differences between the sample before gamification and after the implementation of gamification. This analysis demonstrated that there was a significant increase in students' perceived engagement (p= 0.025) as well as an increase in their perceived motivation after the implementation of gamification (p= 0.009), as indicated in Figure 1. Interestingly, one variable that significantly increased was examining strengths and weaknesses (p=0.009).

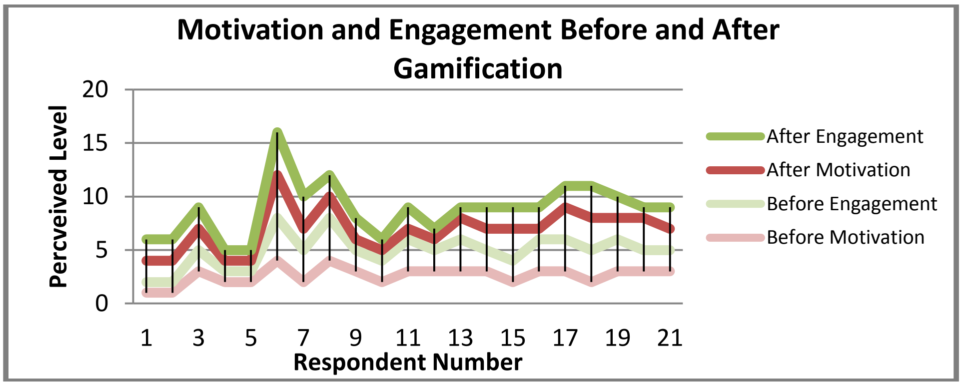

Figure 1: Student Engagement and Motivation: Before and After Gamification

Discussion

This study demonstrates that gamification elements of xp and a leaderboard can be utilized successfully to increase perceived student engagement and motivate students to actively participate in activities that were not formally a part of their assessment. The research conducted may have broader implications for the implementation of gamification in education and perhaps even in management.

There were limitations of this research including the very specific sample used, the relatively small sample size and the self-reporting method used. As the participants were study abroad students, and activities were experiential in nature, this may have influenced levels of participation in the gamification of class. Application of gamification in alternative learning environments and subjects is an area for further research.

The cultural background of the students was largely US American or at very least, students were attending University in US America. The cultural implications of gamification is another area for further research as, according to GLOBE cultural factors, US Americans have high levels of individualism and performance orientation (Javidan & Dastmalchian, 2009). This may influence the degree of competitiveness of the students and, as a result, their level of motivation by the competition stimulated by the leaderboard. Whether gamification would be as effective in other learning contexts and students' cultural backgrounds is an important area for future research.

Another area for further research would be the implications for students at the bottom of the leaderboard. Due to the highly visible nature of the leaderboard, it was important in this study that activities that students could do in order to earn xp were not assessment related. The outcome of the gamification for homework, for example, may yield different results (Goehle, 2013). There may also be further implications for students at the bottom of the leaderboard and whether this serves as a de-motivating factor could be investigated.

Lastly, given the 'low tech' nature of this research, an area that could be further explored is whether high technology scenarios increase student engagement or whether relatively 'low tech' options could be better implemented using the range of technology available.

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Designing learning spaces in higher education for autonomy: Preliminary findings and applications

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Learner autonomy underpins many of the educational outcomes at university such as flexibility, adaptability, self-initiative and self-direction. Indeed, learner autonomy is a key to life-long learning. This paper reports on research investigating the ways designers of innovative learning spaces incorporate customisable, (re)configurable and flexible features that support and encourage learner autonomy. The research aims to elicit high-level design principles that may prove useful in design for learning more generally – including design for learning in virtual and hybrid (physical and virtual) spaces. The research involved seventeen learning spaces across eight universities, observations and interviews with educational stakeholders, and architects and interior designers of those spaces. Preliminary findings suggest designers aim to empower students by providing configurable spaces fitted out with modular furniture and ubiquitous technology – emphasising choice. The paper ends by reviewing the application of these design ideas to broader problems and opportunities in 'design for learning' research and practice.

Keywords: learning space, design, higher education, autonomy, self-directed learning

Introduction and background

As universities develop and re-develop campus precincts and buildings, there is growing interest in providing common spaces for learning, and specialised, innovative spaces for teaching that meet the needs of 21st century learners. Learning space design is complex, multidisciplinary and relatively new. Since Temple's (2008) claim that it is under-researched, the area has experienced growing attention in higher education (e.g. Boddington & Boys, 2011; Boys, 2011; Radcliffe, Wilson, Powell, & Tibbetts, 2009). Quite often, this research extends to examine both the physical and digital spaces available for learning (Häkkinen & Hämäläinen, 2012; Jamieson, Fisher, Gilding, Taylor, & Trevitt, 2000; Keppell, Souter, & Riddle, 2012). The relationship between designed space and student behaviour is emerging as an important line of inquiry that contributes to broader 'design for learning' research and practice. The field of learning space design is producing some useful environments for students. However, Boddington and Boys (2011) rightly question the undeveloped theory informing the design of learning spaces, and they call for effective frameworks that support the design process (pp. xi-xii). To do this, more empirical research is needed. The research reported here investigates the ways designers of innovative learning spaces incorporate customisable, (re)configurable and flexible features that support and encourage learner autonomy, self-regulation and a sense of ownership by revealing design intentions and decisions.

The importance of learner autonomy as an educational outcome has a long history in higher education (Boud, 1981; Brookfield, 1985; Knowles, 1975; Tough, 1967). The concept of learner autonomy has a range of definitions, and is debatable as an ideal (Lewis, 1978), but remains central to contemporary accounts in learning in education and psychology (Tennant, 2012). Learner autonomy is often used synonymously with self-directed learning (Brookfield, 1985; Knowles, 1975), self-regulated learning (Zimmerman, 2002) and learning-to-learn (Hounsell, 1979), but a common theme among these terms is the ability to take responsibility of one's learning. Boud (1981) suggests autonomous learners will (a) plan learning experiences, (b) find resources required for learning, (c) create problems to tackle, (d) choose where and when to learn, and/or (e) learn outside the confines of the educational institution (p. 23). While significant attention has been paid to the importance of autonomy in higher education, rather little is known about how to design for autonomy. The field of language learning offers some noteworthy exceptions (e.g. Cotterall, 1995). As Goodyear (2000, 2005) has pointed out, the core tools and methods of instructional design may work well in situations where outcomes can be tightly prescribed, and where learners are compliant, but they are not so useful when the learning processes and outcomes involve autonomy, self-directed learning, flexibility, creativity, adaptability, and life-long learning.

Reports on learning space design point to some key features of effective learning space. The UK's Joint Information Systems Committee (JISC, 2006) advocates that effective learning space designs are likely to assist everyone within an institution to work more productively and to produce learners who are confident, adaptable, independent and inspired to learn (p. 2). To achieve this, JISC suggest that learning spaces need to be *flexible* to accommodate both current and evolving pedagogies, *future-proof* to enable space to be re-allocated and reconfigured, *bold* to look beyond tried and tested pedagogies and technologies, *creative* to energise and inspire learners and tutors, *supportive* to develop the potential of all learners, and *enterprising* to make each space capable of supporting different purposes (JISC, 2006, p. 3). More recently, Souter, Riddle, Sellers, and Keppell (2011) suggested design principles that (a) create a sense of mental well-being, (b) recognise symmetry, harmony, simplicity and fitness for purpose, (c) create a sense of immersion and flow in learning, (d) consider the needs of cultural and physical differences, (e) offer a mixture of technological and face-to-face pedagogical resources, (f) consider affordances, and (h) enable repurposing.

Methodology and preliminary findings

Table 1 provides an overview of the sites and spaces used in this research, showing which involved observations of students' activity within the spaces and which involved interviews. The sites were not selected randomly (i.e. there is no claim that they are representative of some broader population). Most of the sites were recommended as examples of innovative spaces where it was possible to interview the architects/designers. Eight universities, located in Australia, Hong Kong and the UK, participated in the study. Seventeen learning spaces were involved. Semi-structured interviews were held with eighteen people, mostly architects and teaching and learning specialists, and some interior designers.

Table 1: Research sample of learning spaces and stakeholders

Site	Description	Observation	Interviews with stakeholders
A1	Library	Yes	Architect
A2	Library	Yes	Architect and interior designers (2)
A3	Multipurpose building		Architect
A4	Learning hub	Yes	Architect and interior designers (2)
A5	Learning hub	Yes	Architect and interior designers (2)
A6	Learning hub	Yes	Architect and interior designers (2)
A7	Library	Yes	*None.*
A8	Multipurpose building		Architect
B1	Library	Yes	Architect and librarians (3)
C1	Library	Yes	Librarian and learning space academic
D1	Learning commons	Yes	Architect
D2	Multipurpose building		Architect
D3	Multipurpose building		Architect
E1	Multipurpose buildings	Yes	Learning and teaching academic leader
F1	Multipurpose buildings		Educational development manager
G1	Library		Architect
H1	Multipurpose building	Yes	Academic leader, educational manager, e-learning advisor

Observations enabled insight into the ways innovative learning spaces are being utilised by students and helped to inform subsequent interview schedules. The interviews have been analysed using a grounded theory open coding approach (Corbin & Strauss, 1990). The following six design features emerged as contributing to learner autonomy in various ways. Each feature is discussed and illustrated with a representative quote.

1. Design for a sense of welcoming and openness while keeping a sense of security

Designers described a need for openness and transparency that connects outdoor space with indoor space, as well as new space with existing space. Openness extends to the way spaces should invite people (including the general public). However, it is important for spaces to also provide a sense of security and safety. The use of glass allows light to spill into a space, opens it up and maintains a sense of security. Used in clever ways, glass can open spaces to reveal hidden views of gardens, landscape and other appealing sights.

> We're trying to really blend the welcome into the building through landscapes so it's a physical permeability, so you can walk in, you're welcomed in, it's not shutting you away and closing so you don't feel like you're breaking through a façade to enter the building. (Architect)

2. Design for home-like comfort

The provision of home-like comforts is increasingly used to encourage students to spend both recreational and academic time on campus in learning spaces. Amenities such as kitchens, boiling water, showers, lockers, lounges, TVs, and cafés provide comfort and function to support some basic human needs.

> You get students in there [the library] who are living in there all day and a lot of the night and they're probably spending over twelve hours a day in that library. So it starts to become their home. So you need to provide different settings – lounge settings and kitchen facilities and there's places where people can go and heat up their lunch. (Interior designer)

3. Design for way-finding

Way-finding aids in orientation and makes using a space easier. A hub, a central point of activity and special interest, may act to draw people together, and offer choices such as pathways to facilities and other spaces. Hubs also aid in way-finding or orientation in space and often extend across multiple levels in buildings.

> A hub has all these spokes and the spokes are the students walking towards the hub. (Architect)

4. Design to encourage different types of valued behaviour

Design to support a constructivist approach to learning, and student-centred, collaborative, and experiential learning has emerged as a feature in new learning spaces. Collaborative spaces are often designed for small groups and offer shared tables, large touch-screen monitors, local computers, and large writable walls. These types of spaces have various names, including learning pods, presentation pods and private study rooms. Areas for individual study, large groups and quiet reading are also common features of new learning spaces.

> They want the freedom – they want choice, right? So what does that mean? It means a choice of activity-based learning. So it's about different learning styles. We use architectural division in the space and fixed elements in the space to retain a sense of purpose around the behaviours that we were trying to promote in certain parts of each space and to at least give the university some comfort in knowing that the spaces would hold together. (Interior designer)

5. Design for balance (flexibility vs. fixed)

Designers described a balance of fixed and configurable or flexible components that enable user control and self-initiative. There are some parts of design that cannot be flexible – a fire exit, for example – and there are other fixed components that are often an integral part of a client’s brief. The balance between fixed and flexible features is a challenge that requires a deep understanding of stakeholders’ needs.

> If people don't have the ability to manipulate their environment then they feel constrained and disconnected from it. I think it's a balance between getting the spaces that need to be fixed in their right location, but then allowing the rest of the space to do it's own thing. (Architect)

6. Design for seamless ubiquitous computing

The prevalence of power points and wireless connectivity for students’ personal computing devices is a main feature of modern learning spaces and reflects the increasing use of personal devices on campus. Power is often found at the foot of furniture, indoors and outdoors, and in storage lockers. Students’, personal devices may be connected with university infrastructure such as large sharable touch-screens in collaborative settings. Advances in wireless technology enable stronger signals to reach the more isolated parts of campus and connect a greater number of devices at any one time.

> Power is a massive requirement in every space in this – in the area, because people need the ability to bring out a laptop that has low charge and be able to plug it in. (Architect)

Discussion and future direction

These preliminary findings describe several key design features that enable and support learner autonomy. Boud's (1981) suggestion that autonomous learners find resources for learning, and choose when and where to learn, is *scaffolded* by the provision of open, welcoming and secure (home-like) spaces for learning (features 1 and 2). Without these fundamental features, students are more likely to go home, go to the city, or the park or café down the road. They help make the campus 'sticky'. Closely related to these human needs are spatial way-finding enablers (feature 3), such as hubs, which make finding places, facilities and tools for learning easier. Without these visual cues, navigating space becomes troublesome, which is likely to discourage students. The significance of encouraging different types of valued behaviour (feature 4) is the provision of choice, which is guided by expert advice. Choice is fundamental to the notion of taking responsibility. Fixed and modular furniture, and technology that allow students to plan and customise their learning environment (feature 5) resonates with Boud's (1981) suggestion that planning is a key characteristic of autonomous learning. This design feature provides fertile ground for students to customise their environment as they self-direct their learning. Finally, by enabling seamless ubiquitous computing (feature 6) designers encourage freedom, flexibility, independence, mobility, and agility, which are integral to empowering autonomous learners.

It is encouraging to see parallels between these preliminary findings and the reported design principles for learning spaces described earlier. The next steps in this research involve (1) completing two further iterations in the analysis of the data – axial and selective coding (Corbin & Strauss, 1990), (2) generalising the design features for application to broader design for learning, and (3) conducting retrospective interviews with educational designers to gain insight into how high-level design principles might by applied to educational design. For example, these principles could inform the design of *scaffolds* in virtual and hybrid (virtual and physical) spaces that encourage but not insist upon behaviour that underpins autonomous learning.

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The Reading Game – encouraging learners to become *question-makers* rather than *question-takers* by getting feedback, making friends and having fun.

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Abstract: The **Reading Game** is a question and answer game designed to engage learners in the content of their coursework. The class of student participants creates a collective learning space where every action serves to introduce, build, or clarify concepts from the curriculum. The quality of the multiple-choice questions and the contents of the quizzes are determined by the participants who receive points for their efforts in both asking and answering questions. Participants can comment on and rate questions deemed outstanding by their peers, which directly impacts the contents of review quizzes. Participants progress to the next level of the game using their accumulated points onto asking **open questions** to the teachers and their cohort. Writing good questions is the winning strategy of the game. The key claim in the **Reading Game** is that creating questions is one of the fundamental cognitive elements that guide our conscious reasoning.
Keywords: Continuous formative assessment; game-based learning; meta-cognition; learning taxonomies; discovery; curiosity; crowd sourcing; question asking;

Theoretical Background to the Reading Game

The key claim in the **Reading Game** is that creating questions is one of the fundamental cognitive elements that guide our conscious reasoning (Graesser et al., 2005). For example, in the game, the act of *asking* is recalling; *answering* is recognising; *quizzes* are reviewing; an *open question* is researching; *commenting* is collaboration and reflection; and *rating* is feedback (Walsh & Sattes, 2005; van Staalduinen & de Freitas, 2011). These explicit acts in the game form the architecture for *continuous formative assessment* and *meta-cognition* (Nicol & Macfarlane-Dick, 2006; McIntosh, 2010; Biggs, 1999) that are implicit in the **Reading Game**, by creating webs of coherent reasoning that are built around the difficult questions we ask and the iterative answers we give to these questions.

Further, explanatory reasoning is derived from distinctive classes of questions, such as "*why this and not that*", "*how to do this with that*", and "*what if then this else that*" and so on, that invite the construction of causal chains of explanation, aim-plan-do hierarchies, and logical arguments or mere justifications (Graesser & Black, 1985; Morgan & Saxton, 2006). These classes of questions can be mapped onto hierarchical learning taxonomies like *Bloom's Digital Taxonomy* (revised by Krathwohl, 2002) that allow a learner's progress toward understanding to be determined as well as the nature of the learner's reflective practice. (McIntosh, 2010).

This game utilises some psychological mechanisms (a *desire to win* and the *progression to mastery*) to underpin our question asking and answering, supported by some empirical mechanisms (game thinking and game mechanics, such as: the *challenge achievement pleasure cycle* and *status building*), to contend that educational technology can be designed to facilitate question-lead coherent reasoning, to learn a field of knowledge and to discover its *threshold concepts (*Zichermann & Cunningham, 2011; Schell, 2008; Meyer & Land, 2003).

This project will seek to address alleged student behaviour as passive receivers of course content and asking fewer questions with consequent higher dropout rates, that is reported in recent research (Anderson & Rainie, 2012; Michinov et al., 2011; Tapscott, 2009).

What is the Reading Game? Its Design, Scope, Pedagogy and Evaluation

To any course participant, the **Reading Game** is just that - a game about the content of a course. It leverages *game mechanics* to make the participants' interactions with the game, fun. *Game mechanics* are rule constructs and feedback loops to enable game play of non-game content (Schell, 2008). To the convenor of a course, however, it is much more. The **Reading Game** is a crowd-sourcing framework that enables a group of participants to collaboratively create a learning space in which every action serves to introduce, build, or clarify concepts from the course material by asking questions. The quality of the multiple-choice questions is up to the participants who receive points for their efforts in both asking and answering questions. Participants can also rate and comment on questions, allowing them to directly impact the contents of review quizzes, while activating a secondary reward called 'stars' for those participants whose questions are deemed outstanding by their peers. As the game progresses, participants are offered the opportunity to progress to the next level, which entails asking **Open Questions** by using their accumulated points. The teacher and their cohort of learners provide the answers to the Open Questions.

The unusual presentation of the questions, the points, the progress bar, the stars, the rating system and how questions are answered, are designed using *game thinking* (Zichermann & Cunningham, 2011) rather than a traditional pedagogical model. The aim of this game is to make learning fun and challenging at the same time while taking advantage of the widely reported enthusiasm students have shown for game play (Lenhart et al., 2008, Armitage, 2012) and in a way that complements existing educational tools by integration into Moodle and other learning management systems via LTI; while providing a unique educational experience within contemporary learning management systems.

The completed first stage of the project was to design and code the game as a Moodle module. The second stage is trialling it in two Faculty of Science units in 2013, *GEOS251: Minerals, Energy & the Environment* and *STAT273: Introduction to Probability*, to test the robustness of the code and the user interface. The third stage (in progress) is to go through a code review for acceptance into Moodle as a valid module by Netspot P/L for use in the wider Moodle community. The fourth stage (in progress) is to design a series of pedagogies to use with the **Reading Game** and deploy the analytics from the game to create new teaching opportunities and student engagement. Every learning and teaching technology needs a pedagogy and *vice versa*.

The fifth stage is to deploy it in all faculties at Macquarie University during 2014, with up to eight conveners using the **Reading Game** activity in their *iLearn* (Moodle) courses. For the *quantitative analysis* of the game play, course convenors will be looking at the analytics from the game behaviours (points, stars and comments) and how this correlates to students' performance in the formal assessments in the course. The association between the results of the assessment tasks (whose nature can vary between and within the courses) and the analytics from the game will be assessed with a generalised linear model regression. The regression will be adjusted for demographic covariates and will use data collected from all the students or only from the players of the game, when playing the game won't be a compulsory activity. All the analyses will be performed in R (R Core Team, 2012). Early results show positive and significant association between game behaviours and performance in the assessment tests. This will be measured and aggregated throughout the semester for the whole class.

An ethics application is being prepared so that students' questions and comments can be sighted in the *qualitative analysis* that will look at the types of questions being asked and the improvement or otherwise of individual student's question asking and participation levels measured against the objectives of a learning taxonomy. The investigation will also assess whether it deepens student understanding by a close reading of the course content, by the creation of quality questions that relate to the threshold concepts in the course as the class of participants progress to the next level of the game. At the **Open Question** level participants are well practised at constructing questions, the focus shifts to a deeper understanding of the content of the course. The game uses *crowd sourcing* for learning and enquiry into the course content, so potential breakthroughs in understanding by one student can potentially transfer to others playing the game. The use of this game has implications for curriculum design, learning design for technology use and learning systems. Other evaluation methods will involve student feedback and surveys, unit convenor reflections and peer review of teaching.

What is the value or need for gamifying course content?

The gamification of education lines up with the cognitive processes associated with learning and teaching taxonomies; i.e. serious games if well targeted, pull students through the detailed information onto making higher order judgements (in a continuous gamification loop). If a game is well designed, then irrespective of the nature of the work (i.e. knowledge acquisition) required to play the game, it engages the player with the same cognitive stimulation (i.e. passion for winning or status) and the progression to mastery, by breaking the work down to achievable steps, so it ends up being a fun experience because it creates self-discovery (Schell, 2008; Zichermann & Cunningham, 2011).

The **Reading Game** is not just a quiz and it is not about literacy, it is about discovery and making you part of the knowledge experience by learning how to formulate and respond to questions. We define ourselves by what we know and how we know it; and also by what we don't know and our curiosity to learn. New understandings are assimilated into our consciousness, becoming part of who we are, how we see, how we feel and how we reflect (Cousin, 2006).

The *'learning space'* between receiving and understanding new knowledge provides a useful metaphor to aid our awareness of the conceptual transformations learners undergo, and the stresses that accompany these transformations. But once learners enter the *learning space*, they are engaged in the project of mastery that reformulates their meaning-creation framework by asking better and better questions (Schwartzman, 2010), unlike the learner who merely substitutes understanding for mimicry. The **Reading Game** attempts to create such a *learning space*.

Thomas & Brown (2011), in *A New Culture of Learning*, discuss *'close reading'* as an activity that absorbs the world into you, and that in a changing world, we need the power of the question, not the answer, to discover new ways of knowing, that is specific and relevant to the learner. The **Reading Game** is designed to encourage learners to become *question-makers* rather than *question-takers* by getting feedback, making friends and having fun.

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Higher Education Teachers' Understanding of Flexibility and *Enhancement* in a Learning Management System

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Inasmuch as Learning Management Systems (LMS) are environments for learning, they are also design-spaces for higher education (HE) teachers to assemble content for the coherent presentation of a course. In the age of the *app,* where there is software for any number of digital prosthetics, LMS have attempted design-flexibility by supporting third-party plugins to load within the LMS interface. This is not a new idea and has been mastered in audio and image editing with incredible results in terms of creativity. LMS providers have been slow to respond to digital progress, and current LMS versions seem unable to fully support third-party flexibility; despite the opportunity third-party apps provide to enable creativity and enhancement. This preliminary study has shown that HE teachers, in one institution, do not experience seamless integration of plugins, are unable to keep pace with change and are wiling to have fewer choices of tools with a greater focus on proficiency of them.

Keywords: Learning Management System, Flexibility, Enhancement, eLearning, Learning Design, Integration, Grounded Theory

Introduction

Learning Management Systems have become a necessary technology for higher education providers, as they are able to provide an online space for learning materials and activities to be located with reasonable convenience and accessibility. In addition to this, LMS also support a range of administrative tasks associated with managing student progress and achievement. The modern LMS is also able to go some way in supporting third-party plugin features such as virtual classrooms, blogs, wikis etc. For LMS to fully enable contemporary *rich* and engaging teaching and learning (synchronous and face-to-face in the cloud), they would need to undergo an additional process of enhancement; this means either developments *under the hood* or identifying an entirely new approach for the purpose of; 1) greater learning design choices for the higher education teacher; and 2) more engaging learning opportunities for students. This need for enhancements has emerged because of some universities agendas, in teaching and learning, to "glue [together] emerging telecommunication architectures, 3rd party services, the Internet and vice versa" (Magedanz et al. 2013) and with growing evidence that faculty are frustrated with the lack of flexibility (Abdous 2013) and *seamlessness* of administration functions and pedagogy as emphasized by participants of this study.

In a study by MIT[16] (2011) exploring the technical and user perspectives of an LMS, it was concluded that greater integration and flexibility was needed for future learning designs and teaching needs, citing that the "focus will increasingly shift to the integration of value-added functionality satisfying specific unmet or emerging user needs." Further to this, the study recommended that "such functionality will be identified and prioritized via a community requirement gathering process". Understanding the way that teachers and students communicate with each other should underpin the design of any new LMS.

Further to their technical build, there are challenges with LMS as they have come to be seen as having a "fragmented interface inadequate for engaging and guiding students throughout their learning experiences" (Abdous 2013 p.368). Some of the fragmentation occurs because of the way in which they have been designed around dated ideas about teaching and learning. Weigel (2005) criticises this by describing that -

> […] It canalizes our collective creativity by forcing e-learning technologies into the familiar classroom categories of lectures, discussions, and exams (with an occasional opportunity to chat with the professor or other students "after class"). The overall effect of these developments is that many educators and administrators are locked into a "classroom on steroids" model of e-learning that is more preoccupied with the categories of accessibility and convenience than pedagogical effectiveness and skill development."

This view is somewhat supported by Dabbagh's (2004), examination of the features and components of LMS which highlighted that the challenges within are "…not with their implicit teacher-centered interface or their template controlled authoring architecture…" (which have emerged as the very real difficulties that educators now face) but for …the tendency of early adopters of [L]MS to use only the most obvious and easily accessible components of the tool whose purpose is largely to deliver content and disseminate information…" This problem is echoed in this study where participants emphasized the challenges they were having trying to design LMS-based learning activities that met best-practice pedagogy – particularly in relation to student-peer and self-assessments. Quite simply the LMS fails to provide a straightforward function that is both learner-centred and that enables more complex curriculum developments (Dabbagh 2004, Weigel 2005)

Technology in education, as in any context, ought to include a dimension that breaks with the past, however, and as Weigel (2007) and Abdous (2013) put it, we find our online learning environments constructed around a missed opportunity to provide an answer to the persistent question, that is: how can student engagement be maximized with so many technological possibilities and pedagogical techniques?

Methodology

This Grounded Theory (GT) study was conducted at a university in Victoria, Australia. Grounded Theory (Glaser and Strauss, 1967) provides a rigorous intellectual rationale for qualitative research and its basic premise is that any theory, developed as a consequence of inquiry, will be done so by *grounding* it in the words of participants (the data). This was a deliberate strategy to move away from verifying grand theory and developing new ideas; particularly in sociology (Glaser and Strauss 1967). GT also "allows for multiple data sources, which may include interviews, observation of behavior and published reports" (Goulding, 1998) because its procedures provide researchers with analytic tools for handling masses of raw data (Douglas 2003). Survey data can also be used in a GT study (Glaser and Strauss, 1967) and provides the researcher with additional data sets for exploring phenomen. The methodology is theoretically linked to symbolic interactionism where its use is concerned with the idea that words, gestures and objects, amongst a pre-determined group of people, and the way that they interact, will elicit specific symbolic meaning to them (Blumer 1986). It is also important to stress that since the development of GT in 1967, the authors of the methodology have developed divergent views on how *emergence*, the data analysis process for discovering a grounded theory, should be undertaken (Charmaz 2000). Therefore, grounded theorists ought to name which approach they are applying in their inquiry. This study follows Strauss's approach to GT as iterated in his text of 1987 *Qualitative Analysis for Social Scientists*, which provided an explanation for how researchers could apply this methodology. Strauss emphasized that GT is to be interpreted by the researcher and so, its application is largely philosophical as opposed to technical (Strauss 1987).

Method

Data was collected in the form of focus groups and follow-up surveys. Four faculties participated in the study and the focus groups included a range of academic and non-academic participants that represented executive,

[16] Massachusetts Institute of Technology

managerial, teaching and learning and administrative roles. Three out of the four faculties participated in focus-group discussions, and then completed a follow-up survey that asked them to rank (in order of importance) the tools and functions they felt they would like to see added to the current LMS. Faculty 4 opted to hold a discussion without the need of a facilitator, and then provided a written response listing the range and tools they saw as important. As a result, faculty 4 did not need the follow-up survey.

The focus groups centred on the following 3 key questions:

1. What functions currently work well in the LMS?
2. What functions need to be improved in the LMS?
3. What new functions do you want to see in the LMS?

The follow up surveys included a ranking in order of importance of tools and functions that faculties 1–3 wanted to see in an enhanced LMS. Ranking is represented here as part of the data because the requirements gathering process needed to understand the priorities of faculty. The fourth faculty supplied their own unranked list and the key message was reported as a single priority. The following table lists the top 3 rankings for faculties 1–3 and the single priority from faculty 4:

Table 1: A list of top 3 tools and functions identified as new functions that could enhance the LMS

Faculty 1	• Online marking system (reliable and sophisticated enough to encapsulate teaching and learning practice) • Group management that can handle classes where there are multiple hundreds of students • Collaboration function
Faculty 2	• LMS Templates with design themes to work from • Online classroom • Conferencing tool
Faculty 3	• Online marking system (reliable and sophisticated enough to encapsulate teaching and learning practice) • Track students for a range of T&L processes • Function for managing group work (including ease of creation, tracking & associating with summative grades)
Faculty 4	• Better integration of existing third-party plugins

Emerging Themes

By and large all four Faculties struggled with similar problems and issues; and also requested similar enhancements to the LMS functionality.

Issues with Creating and Managing Student Groups

The general view was that the LMS was not designed for large class sizes and group numbers. This perceived lack of functionality led to a significantly increased workload on teachers and administrators who had to "constantly" manage groups. Some of the problems facing course teams centred on the added burden of administration in applying thoughtful curriculum and pedagogy that relied on groups.

Technological Rate of Change vs. Intensified Workloads

The rate of technological change in higher education over the past few years has been vast. For many teachers who are responsible for learning design and administration in an LMS, it is not possible to stay on top of one's discipline and technology all at the same time. A decision is often made as to whether to pursue research of their discipline (and abandon technological efficiency in teaching and learning), or focus on developing contemporary skills in educational technology and forfeit research, and so, academic promotion. Attempting to keep up with both discipline and technology components of being an academic is wearing people out, and it was perceived that there were not enough people on hand to support teachers in these areas.

Integration

The current LMS and third-party plugins were not totally integrated, and for that reason did not provide a seamless learning design and LMS management experience. Further to this, the LMS functional components, in the words of participants, were “clunky” and *unwieldy*. This required teachers and administrators to devise workarounds, which were seen as inefficient and time-consuming. This issue was magnified by the aforementioned perception that there were not nearly enough support staff to assist teachers in providing the best possible teaching and learning experiences.

Exploring the Meaning of Enhancement

In this study the early conversations as the focus groups and documentation suggested enhancement was the central plank in improving an LMS. And so, *enhancement* (of the LMS) as a shared understanding moved beyond the idea of just technology. In this study the idea of *enhancement* included the following concepts: 1) Software upgrade; 2) Course “window” to manage information at the course level; 3) an efficient group managment function; 4) complete accuracy for transferring student grades to other software; 5) pedagogically driven functions, such as peer assessment; and 6) the opportunity to discuss the LMS with regular users. *Enhancement,* in the case of this study, can be represented as having 3 dimensions, which are, 1) Pedagogical; 2) Administrative; and 3) Collegial.

Conclusion

This study has reported on the emerging themes and meanings that one university has regarding the perceived flexibility and enhancement of an LMS. The core recommendation of this study is that any enhancements ought to be focused on identifying a technical solution that mirrored the reality of the contemporary HE teacher and curriculum. Educators are keen to have improvements to an LMS when those improvements pertain to practical elements of teaching and learning design; conversely they are less keen on improvements that end up being revisions to algorithms that only seem to require teachers to re-develop their existing skills and competencies associated with navigating a cosmetically revised interface. As educators, our focus is on curriculum and pedagogy and technology ought to assist this practice. As it stands, Learning Management Systems have, as in the words of this study’s participants, “clunky” software that teachers have to figure out how to fit a course in and around its functions. So, the current (or future) challenge for programmers is to immerse themselves in the culture of education so that they might begin to understand the needs that teachers and curriculum providers have with an LMS – if, that is, they wish to survive the next wave of advancement for supporting online education.

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A new mindset for a new world - or a return to the ideals?

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The Internet has changed the world and it's business models, but how can universities take advantage of the new potentials for teaching, learning and research, we've only just begun to grasp the scope of? How can the traditional University of Copenhagen change our own mindset and get ready for the future? We created a vision of the university of the future as a "live university": being accessible anytime, anywhere, and open to participation and co-creation between students, faculty and staff.
This is the account of how we aim to use this vision to change our perspective, raise awareness of what technology can do for us, increase our IT-literacy and get ready for the future university - when we don't yet know, what the future holds.

Keywords: institutional change, creating change, vision, professional development, IT-fluency, teaching and learning.

The internet has changed the world - how can universities take advantage?

The Internet has enabled free global communication and made most of the world's knowledge accessible to anyone. Text is no longer the sole king of knowledge and communication - the easy access to creation and distribution of images, audio and video, the mixing and re-mixing of media and the social conversations we can have about them. This not only changes how knowledge can be created and exchanged, but also disrupts the business models underlying every sector. Easy access and communication cuts out any middle man, as the record industry, physical book- and video stores can attest to - this disrupts many of the traditional business models and even copyright. (Meisel and Sullivan 2002, Lessig 2008, Anderson 2006 and 2009)[i] But the disruption is also innovative creating new mechanisms, economic models and opportunities (Christensen 1997, Shirky 2008).
Universities have already been affected by some of the change disrupting the publishing industry, paving the way for open journals and open access academic publications, (Willinsky 2006, Antelmann 2004) and in the realm of teaching and learning, MOOCs have been making waves in the last few years. But we've only begun to grasp the scope of possibilities for research and learning.

This paper is an account of the strategy work we are doing towards 2016 at the Humanities Department, University of Copenhagen, and outlines how we plan to facilitate a move into the digital future (and present), and get the institution and the people it consists of ready to take advantage of all the new possibilities the future holds for teaching and learning.

Where are we now?

The University of Copenhagen is founded in 1479 and a traditional research university.
The current LSM has been in use since 2006, but even though adaptation is good - it is used as a repository for course materials and online submission of papers more often, than as an interactive learning platform.
Pioneer teachers and digital learning projects have resulted in innovative courses and programs, but the vast majority of classes and lectures are not taking advantage of technology.

There is no evidence to suggest that the future generations of faculty and students will have a significantly higher level of IT-fluency. Research has debunked the myth of the "digital natives" (van den Beemt 2011), but even if students should have better skills, the institutional culture is highly change resistant. So the coming of new generations is not going to bring about a sea change on it's own.

Where do we want technology to take us?

The aim is to make use of technology seamless and effortless. We want technology, and our infrastructure, to become transparent. To become tools we use, not something that gets in our way and demands a special effort. Just like nobody talks about "IKT-supported learning" when writing in a word processor, we want it to just be something we do - not something we need to think about.

We strongly believe better technology use can strengthen our core services: facilitate better research, teaching and learning, better education. Many of the existing collaborative online tools can be used to create synergies and cross-pollination between teaching and research. Using technology for learning brings along new perspectives and sometimes surprising gains: streaming live lets guest lecturers participate from around the world, and allow for more diversity. A jointly taught class across the Atlantic lets students and teachers experience the differences in their academic traditions, and see how this shapes their perception of the field. Streaming a language class live, with Twitter as a backchannel, gives the teaching a broader reach and grants a wider access to education.

We want to open up and make the university and our content accessible, so we can become a platform for knowledge creation, sharing and learning. We want to engage and draw in students and society, to add to, re-use and remix the resources. And even more possibilities for enhancing, supporting and changing education and facilitate learning and research will emerge in the coming years, raising questions like: Can we gain a better quality of research by sharing our research data openly? Or can we crowdsource or even crowdfund our data collection, and at that get better samples, larger datasets and more reliable results?
Betting on a single current trend to shape our future will just make fools of us all, so what we need to do, is to create an environment, where we are aware and ready to use the new opportunities as they arise.

What do we need to get there?

A change in culture and attitudes of both employees and students is needed, particularly to our self-image: Because our university is not only an old-fashioned place - it is also a place where a student tweets his translation of the Gothic language live over the wifi of a bus on an Israeli motorway. But even those involved consider this an exception from the rule - and most faculty are not even aware these are viable options, so it doesn't occur to them to think outside the box of the classroom, when they plan their teaching, even if many of them are interested in doing so.
So as a supporting tech-unit, we realised that we need to change our focus. Rather than trying to get more academic staff to try new things, we need to work more strategically at an institutional level to support change. We suggested the digital strategy work under the title "Live University". The deanship of the faculty immediately embraced the suggestion, and made it one of the 12 major themes of the faculty's 2016-strategy - a great first step, as commitment from management is crucial for success, when implementing change.

How do we get going?

To change the attitude and self-image of a traditional university is a tall order - and there is no technical quick fix for this. But to set the institution in motion in the same direction, we need a goal... or several goals. And since we're talking about web-technology, where no one knows where we'll be in 5 years, and certainly not in 10 years - we created a vision we can aim towards.

We call it "Live University", to signal that we want the university to be live, not just during teaching hours, and on campus - but anytime, anywhere - and not just broadcasting one-way communication, but open to participation and co-creation of knowledge. And Live University is a vision of a university, which utilizes technology to be active and collaborative anytime and anywhere. The values underlying Live University are the same kind of values of the Internet and the open source cultures that helped shape it: Openness, sharing, collaborating and taking responsibility and contributing. Ideals that may not be the perfect image of a modern day university - but isn't it really the ideals the university as an institution was founded on?

The vision is a means to give us all a common sense of direction, allowing more people to be a part of the change, to see their efforts as part a greater change of moving the institution in a new direction - even when turning a super tanker is slow.
A vision is vague in nature, and this is an advantage, since we're navigating in unknown waters: our change needs to have direction, but be open to what new possibilities will emerge in the years to come. Therefore we

are not focusing on any particular technology - video or live streaming might be the big thing right now - and as such we shall explore the options, but we don't want to limit ourselves, as it may not be, what (alone) ultimately serves us best.[ii]

Where to start the change...

So how does a deliberately vague vision translate into action, and actual change? At the heart of our vision is a change in attitude about how we, as an institution use technology.
This is a complex matter - but we've grouped our efforts into three main areas:

- Infrastructure
- IT-fluency / professional development
- Opening up the university to the outside world

Infrastructure

Our infrastructure needs to support the use of technology - and that goes for the rooms we teach in, as well as the human resources in support functions. For technology to become transparent and our services to scale beyond supporting a few tech-pioneers, we need plug and play solutions in the classroom, access to and support for relevant web platforms and tools.
We're already doing pretty well in this area: We have a dark fiber infrastructure for AV and streaming in much of our campus - and a great collaboration between different units handling operations and maintenance of IT, buildings etc. There is still work to be done coordinating and improving our services and different ventures handled by different units, but in some ways this part of the change is the least complex, as it can be handled by existing support units and incorporated into their development plans for the years to come.

IT-fluency / professional development

Faculty, students and staff need to have the skillset and competences to reap the benefits of technology. So the aim is to increase the all-over level of IT-fluency. Our faculty, staff and students do not need to become super-users of every single technology, but they need to have the ability to choose the best and most relevant tool, service or solution for their need, knowing their range of options (but not necessarily the details of each).
Better general understanding of how we can use technology is needed for everyone, as digital outputs are becoming the norm for projects at large - and to get better results we need to incorporate digital early in the process, not think we can hand it off to some programmer, who can make something of it afterwards.

Status here is a complex picture. There are extreme differences in skill levels and needs, and this goes for all staff and students. And in this area there are no easy solutions, but we need to find scalable solutions, probably through a combination of efforts. An institutional and managerial focus on the area will raise consciousness and underline the strategic importance, we also need to include "the digital angle" in all the existing offerings - mandatory teaching certificate courses, PhD-training courses etc. But we also need to create new ways of entering the digital domain for our tenured staff, and those need to be relevant and useful in their existing practices - if we can't answer the crucial question "What's in it for me" - our success rate will be low. Mentoring and "teach a colleague"-schemes as well as just-in-time courses can be part of the solution - and it's well looking at successful programmes from other universities, as most face the same problem.

Opening up the university to the outside world

To change our perception of ourselves and the institution, an important step is to make visible and known the existing efforts, projects and products. We need to share our success stories from the digital domain, because people are already doing great things. We also need to create frictionless access to all the units at the university working with the related areas: Teaching and learning, IT-infrastructure, e-learning and communication. And at an institutional level we need to create even better collaboration between those and common and coordinated strategies.
Status here is that a lot of things are moving in the right direction - but we also have hurdles, that we do not necessarily have ways of getting around in a short-term perspective. Copyright is one such topic. A long culture of not sharing research before publication is another.
However there are also winds blowing in the right direction - there is a strong pressure from the government to digitize and make our communication and content accessible to students on digital platforms. Our students are central in this effort, not just because students are our future generations of teachers and researchers - but also because a modern university should educate students with digital skills and knowledge - and a way for them to hone their digital skills is participating in digital knowledge sharing, while at the university - thereby being an important part of the open and collaborating live university.

First steps

We're already working to strengthen and create networks between staff, faculty and units with an interest in the affected areas: infrastructure, IT, teaching and learning, etc. The immediate goal is to spread the idea, boost enthusiasm and locate resourceful and interested people, who can join in the next task: To co-create and define the next moves in the process.

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Exploring Connected Learning Spaces in Teacher Education

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This paper reports on outcomes from a study that explored how connected learning spaces, mediated by videoconference technology, enabled real-world engagement in pre-service teacher education. Student teachers in drama and science education participated in the study, which involved varied connections with school children and their classroom teachers. Key themes that emerged were underpinned by a consideration of authentic learning: student teachers' observations of teacher practices; enactment of multiple roles; and exposure to diverse and timely feedback. Implications for the design of discipline specific on-campus activities are considered in relation to how they inform effective integration of videoconference technology for real-world, professional engagement in teacher education.

Keywords: teacher education, videoconference, authenticity, learning spaces

Introduction

This study contributes to a broader consideration of how connected learning spaces enable real-world engagement in teacher education. Focusing on drama and science education subjects in a Bachelor of Primary Education degree, it explored pre-service teacher learning in these contexts from the perspectives of student teachers, school teachers and teacher educators. Discipline-based ways of using the technology and associated pedagogical insights also were explored. Findings are underpinned by notions of authentic learning, and focus on opportunities for student teachers' observation of and immersion in professional practices, enactment of a range of roles, and exposure to spontaneous feedback from diverse sources.

Background

Videoconferencing in education

Videoconference (VC) technology has been available since the 1950's, most often located in corporate training, rural and remote schooling and post-secondary distance education. The term videoconferencing is used to describe a system where two or more participants in different locations interact using video cameras and other equipment through an Internet connection (Smith, 2003 cited in Kent & Simpson, 2010); while educational videoconferencing can be viewed as "people learning interactively by seeing, hearing, and sharing over distance in real-time..." (Tuttle, 2008, p. 200). VC has recently become a more significant teaching and learning tool in mainstream education, as fast, high bandwidth networks become commonplace in institutions, and equipment becomes affordable and more user-friendly (Anderson & Rourke, 2005). VC has traditionally been used in education using transmissive, didactic approaches such as the delivery of lectures between sites (Knipe & Lee, 2002) or the provision of guest speakers. However, the synchronous, interactive nature of VC can support more emancipative pedagogies, allowing interactive approaches that support more collaborative learning environments (Wright & Cordeaux, 1996). For example, VC offers potential to support discussion and collaboration and the "active exchange of knowledge and ideas which nurture critical thinking skills" (Bidjerano & Wilkinson, 2008, p.126).

'Connected Classrooms' in school education

The present study was implemented in the context of unprecedented government investment in ICT in Australian schools. The Australian federal government launched a multi-million dollar *Digital Education Revolution* (DER) initiative in 2011 to support schools in embracing technology and effectively integrating the ICTs into the classroom (DEEWR, 2011). Similarly, the New South Wales (NSW) State Government announced its $158 million *Connected Classroom Program* in 2007 that included amongst other initiatives, an 'interactive classroom' in every school. These 'connected classrooms' comprised an interactive whiteboard, video-conferencing facilities, a computer with internet connection and lesson creation and data collaboration software. In her evaluation of the *Connected Classroom Program,* Groundwater-Smith (2010) reported that school teachers had learned to function in new ways in these VC-mediated learning spaces, and exploit their ability to connect "to other schools, other places, and other colleagues" (p. 49). Amongst other benefits, the report gives evidence of enhanced opportunities for collaboration for school teachers and students, participation in virtual excursions or events, and access to specialist teachers and external experts.

A range of VC-mediated learning activity types have been explored in school settings, including virtual field trips, multi-class collaborative projects, cross-cultural exchanges and content-delivery; with many studies reporting the following benefits: participation, interaction, dialogue and collaboration (Anderson & Rourke, 2005). Videoconferencing allows opportunities for school students to enhance their learning experience across various subject and content areas. For instance, students can have access to various institutions such as museums, hospitals or astronomical venues, including 'live talks' from experts (Plonczak, 2010). The literature surrounding the use of videoconferencing within and between schools to facilitate collaborative learning in specific subjects is also well documented (Eales, Neale, & Carroll, 1999; Gage, Nickson, & Beardon, 2002; Smith 2010). Likewise, videoconferencing has played a significant role in supporting students with special educational needs who may be situated in rural areas (Donegan, 2002; Thorpe, 1998).

Teacher education contexts

Much of the literature on VC in teacher education focuses on the nexus between university and schools and strengthening the link between theory and practice. BECTA (2003) highlighted three benefits of VC for teacher education: observation of school classrooms without being present in the school, sharing of ideas and teaching resources, and mentoring whilst on professional experience. Virtual field experiences, observing classrooms, cyber-mentoring, cyber-teaching, and supervision on professional experience were emphasised by Smith (2003, cited in Kent & Simpson, 2010, p. 13). Tuttle (2008) outlined several types of VC uses in teacher education, including: accessing experts, university-to-school connections, peer-to-peer student teacher collaborations, peer-to-peer Faculty collaborations, mentoring and observing student-teachers on professional experience, and professional networking.

There is a strong emphasis in the literature on the use of VC in professional experience contexts (e.g. Barnett et al, 2008; Crawford et al, 2002; Stansberry & Denker, 2012). For example, Sharpe et al. (2003) found that student teachers on professional experience that used videoconferencing as a collaborative learning tool between themselves and university supervisors, benefited through 'sharing of ideas' and reduced stress levels through peer support. Similarly, Melville et al. (2011) found that videoconferencing can play a role in supporting student teachers' reflection processes and identity formation during professional experience.

Student teachers and teacher educators can also link with school teachers from campus-based classes through videoconferencing to observe scenarios, discuss phenomena and reflect in real-time with participants (Marsh et al, 2010). Such a redefinition of classroom boundaries is providing a way to enhance the initial teacher education experience through the use of VC (Wiesemes & Wang, 2010). By employing other kinds of technologies with videoconferencing, student teachers can benefit from non-lecture based interactive sessions such as brainstorming, role-play, simulations and demonstrations. However, there has been less emphasis on discipline-specific uses of VC in campus-based teacher education classes.

Strategies associated with campus-based pre-service teachers' observation of real-world K-12 classrooms via videoconferencing have been recently explored. In a study by Kent and Simpson (2010), pre-service teachers on campus were given the opportunity to observe reading instruction in schools through videoconferencing and then interact with the classroom teacher, thereby creating exposure and experience for pre-service teachers to develop their conceptual understanding of research-based, best teaching practices in reading. Similarly, pre-service teachers used videoconferencing technology to observe literacy being taught in a classroom and then reflect on the lesson "by conversing with the teacher via distance learning" (Barnett et al., 2008, p.1). Additionally, in language education, pre-service Spanish teachers watched and analysed a drama production before further exploring their analysis with the production's director and actors through videoconferencing (Tuttle, 2008). The integration of video-conferencing in a social studies methods course was explored by Good, O'Connor, Greene and Luce (2005). Their findings revealed that pre-service teachers' content and pedagogical learning was enhanced through being exposed to different perspectives from outside of the university, sharing of resources, as well as engaging with guest speakers and future social studies professionals from other regions.

In summary, research on the use of VC in discipline-specific, 'method' classes in teacher education is in its infancy and further research is needed in this area (Kent & Simpson, 2010). This study contributes to this literature base by exploring the use of VC in science and drama teacher education. This focus also fits well with the research agenda informed by the TPACK model of teacher knowledge (Koehler et al., 2011), calling for further studies on the nuanced, discipline-specific integration of technology in the curriculum.

The study

This qualitative study is set in the contexts of pre-service science and drama education at an Australian university. These discipline areas provided the focus for the study as a result of the particular academic staff members that were teaching these subjects sharing an interest in integrating VC technologies. Attentive to the reciprocal relationship between educational technologies and pedagogical approaches (Salomon & Almog, 1998), it develops an understanding of the qualities of the experiences in two distinct disciplinary subjects, created when student teachers interact with emerging VC technologies. The study employed an interpretive methodology (Erickson, 1986; Lincoln & Guba, 1985) to explore the use of VC in pre-service teacher education, investigating the key research question: *How can connected learning spaces enable real-world engagement in teacher education?*

Participants and procedures

Teacher education staff and student teachers involved in two drama education elective subjects and two science and technology education core subjects participated in collaborative VC-mediated activities with school-based teachers and children in Sydney primary schools during 2011 and 2012. All student teachers were studying in the four year Bachelor of Education (Primary) program. The VC-mediated spaces acted as a 'test-bed' environment for the student teachers to test their ideas and emerging professional competencies. The VC equipment used in the study consisted of a permanently installed 'room system' (or 'connected classroom') at the university, connected via a fast, high bandwidth network to similar rooms in the six participating NSW public schools.

The two drama education subjects involved 3rd and 4th year student teachers (total of 35 student teachers) in a creative process of exploring, building, rehearsing and performing for primary school children via the connected classroom technology. VC activities included conversations with children and school teachers in preparation for, and reflection on, VC mediated drama performances, rehearsal performances gathering feedback from peers, rehearsal opportunities utilising the self-feedback capacity of the VC setup, as well as the live performances themselves. Assessment was tied into the VC-based work of each class.

There were two science and technology education subjects in which student teachers participated: one 2nd year subject (137 student teachers in 5 classes) and a 4th year subject (77 student teachers in 3 classes). VC activities for science were also varied. For 2nd year student teachers, this included a connected session between student teachers and a panel of classroom teachers from the same school, to learn more about how they approached planning and teaching science and technology. The 4th year student teachers experienced a facilitated connected session with a panel of children from Kindergarten to Grade 6 to hear what they had been learning and to support preparation for a subsequent face-to-face school-based science day. As with the drama subjects, VC activities related to class-based assessment.

Methods

The qualitative research methods employed in the study were designed with the purpose of gathering triangulated data from the adult participants in the VC sessions, who also shared their impressions of children's participation. There were four methods used: student teacher (coded S in findings) and school teacher (coded T in findings) written reflections on their experiences in the VC spaces (guided by broad focus areas), student teacher focus groups, collaborative peer observation (Pressick-Kilborn & Te Riele, 2008), discussion and written reflection amongst academic staff (coded A in findings). The two academic staff engaged in teaching the subjects (authors 1 and 2), along with the third author of this paper, engaged in the collaborative peer observations and critical collaborative reflective discussion (Bullough & Gitlin, 1991) after each session. Participant written reflections included student teachers' responses to stimulus questions from academics; school teacher written reflections and notes from conversations with academic staff; academic written reflections, including notes made during collaborative discussion; and email messages exchanged between academic staff following the VC sessions.

Data were analysed using qualitative methods and sorted (Coffey & Atkinson, 1996) in multiple ways to allow themes to emerge, but also for the experiences of individual students to be respected (Connelly & Clandinin, 1988; Perry, 2006). Key themes and patterns from initial drama-based data were identified (Coffey & Atkinson, 1996). Preliminary thematic analysis of responses then guided the ongoing data collection in both drama and science subjects. Themes were again placed as a lens over the new data with additional themes emerging. The establishment of preliminary themes allowed for broad focus areas to be developed that guided the ongoing data collection. As these broad focus areas were applied across all methods (written reflections, focus groups and observations), triangulation could take place considering the various participant groups and sources.

Findings

Three key themes emerged in analysis of the data. The themes relate to how VC technology enhanced student teachers' 1) observations of teaching practices, 2) enactment of multiple roles, and 3) receipt of immediate feedback from diverse sources.

Enhancement of student teachers' observation of teaching practices

VC connections enabled student teachers in both drama and science to witness classroom teachers interacting with primary children, and in science with other school-based teaching colleagues. Connections provided a window into the real worlds of the school classroom, extending beyond passive, 'fly-on-the-wall' observation to simultaneously involve a variety of interactions and questioning by student teachers. Opportunities were created for student teachers to: 1) observe school-based teacher practices in drama or science, including classroom teachers' professional interactions with children and colleagues; and 2) observe their lecturers as teachers interacting with children and classroom teachers.

Firstly, VC connections engaged the student teachers in observing how school-based teachers mediated children's engagement in the connected space, in both the context of the drama performances and their interaction between children when planning for the science day activities. The practising teachers either engaged directly with student teachers or played a mediating role between children and the student teachers. The pivotal role of the classroom teacher made an impression with student teachers in both contexts—many of them highlighting the importance of observing this role, particularly for initiating more dialogic interactions (Beauchamp & Kennewell, 2010) in these connected spaces: "I think to do it without having a [school] teacher being there… prompting them, it would have been much harder. Like she was really helpful being like "It's ok". Getting them started off, "Tell them where the rainbow fish is!" (Focus Group, 2012 drama). Another student said:

> It [having classroom teacher facilitating response] was really helpful for me in the interaction thing. I could look at the kids and she could get them to react back to me. 'Cause I didn't have to look at the screen to choose someone, she did that for me so I was able to maintain that contact with them. But that was, I think, was pretty vital for the interaction. (Focus Group, 2011 drama)

These perceptions were reinforced by one of the science lecturers, who noted in her reflective notes:

> T [classroom teacher] played an active role in engaging and focusing the children on relevant aspects of their learning, which prompted the children's reflection and provided student teachers with insight into the children's understanding and enjoyment of the science … T was playing a dual role - teacher and teacher educator. Her questioning of the children was very strong and provided a role model for the student teachers in how a skilled teacher can elicit students' ideas." (A2 reflection, 13/8/12 science)

The communication between the key collaborators at each site prior to the VC sessions was important to ensure that the class teacher's questioning of children was focused and purposeful, as a peer academic observer noted in science: "The classroom teacher … effectively mediated the first half of the session. She skillfully probed the children's thoughts and asked them pertinent questions, obviously well-informed by previously set goals and directions negotiated with academic staff" (A3, Peer observation 13/8/12 science).

Student teachers also had opportunities to observe classroom teachers engaging professionally with colleagues through the VC connections. In science, student teachers connection with a panel of school teachers provided an opportunity for modeling for the pre-service teachers, who observed how practising teachers engage collaboratively in professional discussion. The drama students noted a similar benefit, with one stating: "So you really see that in that kind of scenario, the teacher needs to be a collaborator in the process" (Focus Group, 2011 drama). It also gave student teachers the chance to test their own skills in contributing to such conversations. Student teachers reflected positively on the experience of interacting with the practising teachers: "I loved being able to talk to new [school] teachers and draw from their knowledge. I feel that it is one of the best ways to gain knowledge, is through people living life every day" (S15 science); and "Yeah, but just that collaborative learning is just so, it makes it so real" (Focus Group, 2011 Drama). Another science student mentioned: "I thought it was a great opportunity to connect to school teachers. I am finding that it is important for my development as a teacher to get as many differing views on teaching ideas and practice as possible" (S1 science).

Secondly, student teachers observed their lecturers actively engaging with primary children and school-based teachers during the VC connections in both subject areas. Student teachers rarely see their teacher education lecturers modelling the role of primary teachers. The importance of this modeling was noted: "A1 giving student teachers guidance related to asking more responsive questions, building from children's responses" (A2 peer observation notes 29/3/12 drama); and "Good team teaching between A2 and NN teachers - bounced off each other to share and discuss" (A1 reflection, 5/4/12 Science). The student teachers also required prompting from their lecturers to engage productively with the children during the VC connections: "Student teachers needed a fair bit of prompting to ask questions. Maybe a confidence issue - students not knowing how to phrase [questions]" (A1 reflection, 5/4/12 science). In this way, the VC connections provided an opportunity for the lecturers to model professional engagement with children and school-based colleagues. The connections also supported student teachers in taking on multiple roles during campus-based classes.

Opportunities for student teachers' enactment of multiple roles

The connected classroom experiences in drama and science created opportunities for student teachers to actively participate in the VC scenarios adopting multiple roles, some of which are only usually possible enacted in the field. Some of these were expected, including that of student teacher ('teacher-learner') to actual teachers through their interactions with children in both subjects. Others were less expected, including those of facilitator, actor, performer, theatre designer, writer and director for the drama students and inquirer and collaborative investigator for science. The VC experiences offered students the opportunity to enact and switch between these roles spontaneously while located on the university campus. Staff noted this benefit: "So much is dislocated from the classroom and professional experience can be also quite separate in their minds. Bringing the two together in this style of learning experience gives authenticity of purpose" (Peer discussion, A1/A2 9/3/12). These experiences functioned as a springboard for student teachers to enact their own VC-mediated plans and associated teaching roles in their own classrooms.

The intimate relationship between metaphors and teacher identity has been long recognised (Bullough & Stokes, 1994, Pullias & Young, 1968) with roles such as professional and researcher discussed (Goode et al., 2004). While not explicitly questioned regarding the roles they adopted, students alluded to role adoption in their reflections through references to opportunities such as walking in the shoes of the children, "seeing it [drama performance] from the perspective a child audience will be watching it" (S5 reflection, 2011 drama) as well as a consideration of the teacher as actor (student reflections, 2011 drama). The opportunity to position children as collaborative and self-guided learners was also considered emphasising again the teacher role of a 'non-intrusive' facilitator (S3 reflection, 2011 drama).

There was evidence of several student teachers enacting their VC plans during their subsequent professional experience in schools. For example, one drama student teacher modelled the process she experienced at university with a Grade 5 class. This engagement clearly demonstrated understanding gathered through her experiences of the unique nature of performance via VC, with her stating "we ran through things like focusing on the camera and not the screen, and adjusting voice projection according to where they were standing, and keeping background noise to a minimum" (S11 reflection, 13/10/11 drama). Other student teachers who planned and enacted VC-mediated lessons at their school reported positive children responses. Their own school students appreciated the authenticity of their VC experiences. For example, one student teacher reported on a recent VC class session with NASA during her professional experience: "Most said it [video conference hookup] was cool that we heard from a real person that is doing the training rather than just reading from a book." (S10 17/10/11 drama). Another student teacher incorporated VC into her English lesson:

> The kids loved using it and allowed them to participate even though they were 8 hours away from the other candidates. They got to participate in real time with real officials - great because regional schools could participate and not have to travel. (Regarding participation in National Spelling Bee) (S12 17/10/11 drama)

These reports affirmed the student teachers' own notions of connected classrooms as a conduit for real-world engagement.

Engendering immediate, diverse and authentic feedback

Another theme that emerged from the data was the role that VC technology played in enabling student teachers' exposure to spontaneous, valued feedback from diverse sources that would not usually be available to them on campus. Three sources of feedback allowed student teachers to 'test ideas' and were evident in the data gathered: self-feedback, feedback from children and practising teachers. The immediate, synchronous nature of the feedback was a feature of the VC scenarios for student teachers: "Live and interactive... I think that is the unique feature of the Connected Classroom. That is what it really brings to teaching and learning" (Focus Group, 2011 drama) and "It's all about live and real time. You can ask questions, you can have access to anything that is available" (Focus Group, 2011 drama).

Firstly, the drama student teachers commented in their focus groups that rehearsing in front of the camera, and then performing via VC provided them with useful self-feedback on their performance. The dual screen view of the VC (see Figs. 1 & 2) enabled the student teachers to see what the children in the audience would see, and some made observations of the affordance of the technology in providing 'real-time' feedback that contributed

Figure 1. Dual screen view of the VC facilities in drama context (school audience on RHS)

Figure 2. Dual screen view of the VC facilities in science context (school audience on RHS)

to refining their own performance: "Without meaning to sound egocentric, even just the experience of seeing ourselves acting was useful for me to notice/correct things in my own acting. Even just switching in the camera can be useful for children acting" (S1 2012 drama); and "I found it [seeing self on screen] helpful actually because if you knew you were on screen then you knew that they could see you and you had to always keep looking at it, not in a distracting way" (Focus Group 2012 drama). Similar benefits were noted by one of the observers:

> The student teachers were comfortable using the technology, but did tell me at the end of their rehearsal period that they had to rethink their blocking based on the technology (they had worked the week before on the basic structure). They found that being able to see what children view opened up new possibilities. (A1 reflection, 22/3/12 drama)

The timely feedback helped the student teachers to develop their use of acting techniques more broadly, but for the nuances of performing using this hybrid theatre/film medium more specifically. As they drew on the ability to see themselves as afforded by this particular technology, they used what they viewed as a source of development. In contrast, the nature and purpose of the science connections did not afford the same possibilities for self-feedback for student teachers.

Secondly, feedback from children was highlighted by both student teachers and academic staff members as being of particular value. Children's participation in conversations with student teachers informed planning in both the science and drama contexts prior to the science day and performances respectively. Constructive feedback and the potential for audience inquiry were features that drama student teachers experienced. They were initially concerned about receiving the crucial response central to, and characteristic of a Children's Theatre performance. However, these concerns were alleviated as they experienced spontaneous feedback from the audience. One student teacher mentioned: "They [children] are rethinking...critiquing, however basic what you're doing and thinking about it in terms of what they're reading and learning, so it adds a whole other level of analysis … " (Focus Group, 2011 drama). Another student appreciated the supportive nature and spontaneity of the feedback: "This is another avenue to collaborate about acting/theatre with people you would not necessarily be able to access. It could help reduce anxiety about the audience viewing. They can encourage immediate feedback and question from performer or audience" (S5 2012 drama).

Science lecturers also reflected on the value of children's feedback for student teachers' planning of relevant school-based science day activities. This authentic feedback source was perceived as purposeful, meaningful and adding enjoyment to the planning process: "They had been generating ideas for possible design and make tasks, that they would actually be planning and teaching with children at the school. The video conference gave them the opportunity to test their ideas with the children" (A2 reflection, 13/8/12 science). Another lecturer mentioned:

> The student teachers commented that they really enjoyed hearing from the children about what they had learnt … One other thing was how important it was for the students to pitch their lesson plans as stage/age appropriately as possible and seeing children from all stages K-6 [during the VC connection] and the children's ability to articulate scientific learning and ideas facilitated that fine-tuning of the student teachers' expectations and ideas for the preparation of the design and make task. (A4 reflection, 13/8/12 science)

Thirdly, student teachers valued the feedback they received within VC connections from school teachers in the partner schools. In science, this was evident when classroom teachers drew on examples from lessons they had just taught in the responses that they gave to student teachers' questions: "This was a great experience and opportunity to speak to teachers who are currently involved in teaching, particularly science and technology. It was great to ask more practical questions and get 'real' responses" (S4 2012 science). The answers that the practising teachers gave during the VC exchange were appreciated by this student teacher, who believed that she could trust the experience of these school teachers to inform her own future practice.

However, many pre-service teachers critiqued the potentially impersonal, less intimate nature of the 'connected classroom' and children's possible perception of VC as a passive medium. They mentioned in focus groups that they perceived face-to-face environments as easier to elicit feedback. For example, one drama student mentioned:

> At first the kids were a little bit tentative to respond…and perhaps that's because they're used to screens being a passive thing, like they're used to watching movies on TV and they're not used to having to respond to it. Where they're used to responding to people face to face I guess. (Focus Group 2012 drama)

Another school teacher whose class was participating in the drama activities reflected that:

> I found it interesting that the quieter students (who had valuable information to share) did not feel comfortable speaking up in this forum while they would have in class. They were overwhelmed perhaps? It will be interesting to see if they speak up next time. (School Principal reflection, 9/3/12 drama)

These comments highlight that the VC medium may have been inhibiting for some children and raises a broader issue, in relation to the importance of children being prepared for *how* to participate as an audience through VC. It was more likely that the children didn't know *how* to respond, not having previous experience as an audience to draw upon. This points to the value of designing opportunities for repeated engagements through VC, so that all participants become familiar with the medium and more comfortable engagement with one another, leveraging effective feedback.

Discussion

This study was conducted within a higher education climate where a consideration of 'spaces' for learning is an increasingly prominent issue resulting in implications for the role and place of technologies such as videoconferencing. Teacher educators in Australian universities are engaged in looking into ways of including and incorporating videoconferencing as a teaching and learning tool in their own classrooms, not only to leverage opportunities provided by recent infrastructure investment and to innovate their own teaching practices, but also to educate and equip future teachers to the possibilities of videoconferencing across the school curriculum. They seek to develop their own connected classrooms, partnering with schools, other universities and content providers such as cultural institutions, museums and professional organizations.

The deconstruction of traditional classroom boundaries between the university and school contexts allowed for the real-world engagement, providing opportunities for observation of and immersion in teaching practices with multiple roles to be played by student teacher participants. The breaking down of boundaries supported the provision of 'real-time' authentic feedback in the drama context, enabled by the nuances of the technology itself (e.g. self-feedback via the dual screen). This allowed for adjustments to be made, enhancing student teachers' understanding of the unique features of the connected classroom 'stage'. Similarly, valued and timely feedback was provided by children and school teachers in science to inform the student teachers' final tasks for the subsequent science day at the school.

The connected classroom is a unique environment, for example, for structuring performance and as a result engagement in drama education. The study raised important implications in regard to developing student awareness of the nuances for drama performance as experienced on this hybrid 'virtual stage', and what this meant practically for the performers and performances themselves. Many drama student teachers in the study welcomed the connected classroom as a suitable space for novice actors, and perceived the VC-mediated audience as less intimidating and a possible way to reduce anxiety. The VC activities, particularly in drama, became a 'deep play' experience (Koehler et al., 2011) for the pre-service teachers, enabling them to explore creative ways of using the VC facilities and develop more nuanced understandings of the technology for their own teaching. Further research into implications for performance more broadly, opportunities for performance where 'actors' work simultaneously across spaces, along with what drama learning through the use of VC technology means for school-based pedagogical design in drama education should be considered.

Collaborative learning mediated through the VC technology was witnessed in both discipline areas through the engagement of student teachers with school children and their teachers. This constitutes a move toward "the students doing the learning rather than the teacher doing the teaching" (Willey & Gardner, 2010, p. 2). Such a student-centred perspective on student learning is crucial when considering future discipline-specific opportunities for VC, and should guide an understanding of the kind of activities that can be designed for enabling effective real-world engagement in teacher education. Such real-world engagement is consistent with a perspective that professional learning is not just confined to the "tangible boundaries of a physical classroom ... but involves a diverse range of spaces enriching the learning and teaching experience of both academics and students" (Keppell & Riddle, 2012, p.1). Subject-specific nuances and opportunities for application of VC in future teaching practice and associated pedagogical understandings should be considered.

This study adds to the growing research literature on the use of learning technologies and new learning spaces in teacher education. It responds to calls for more discipline-specific research in this area (Koehler et al., 2011), by emphasising ICT-supported, discipline-specific pedagogy in drama education and performance allowing alternative forms of theatre to be explored, as well as inquiry-based science teaching. While common themes emerged as relevant to both discipline areas, the way they played out were unique and this reinforces the need identified by Kent and Simpson (2010) and Koehler et al. (2011) for further discipline-specific research to be conducted. VC activities in the two subjects considered in this study brought together university and school-based learning in a hybrid of time and place, using VC between teacher education students and staff, and school-based teachers and children.

Conclusion

Use of VC technologies facilitated discipline-specific professional engagement for the pre-service teacher participants in this study. The connected classroom facilities enhanced observation of and immersion in school-based teacher practices, and leveraged unique opportunities for the student teachers to receive authentic feedback from children and practising teachers on their drama performances and science inquiry projects. In this way, the VC-mediated spaces acted as a 'test-bed' environment for the student teachers to refine their teaching ideas and notions of professional practice, and develop their emerging professional conversation and performance competencies.

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Piloting an online mathematics and statistics tutoring service

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In early 2013 the Mathematics Education Support Hub at the University of Western Sydney launched a tutoring service to support students' mathematical and statistical learning in an online environment. Until the end of its pilot implementation in mid 2013, the service operated at all times as a moderated question and answer forum located within the University's Learning Management System (a version of Blackboard Learn known as vUWS). It also featured a 'virtual classroom', which allowed students to interact with mathematics and statistics support staff in a web conferencing space equipped with a wide range of digital communication tools. This paper refers to the service as it was offered in discussing a range of general issues and questions associated with its pilot implementation. Particular attention is given to the issues of pedagogy in a purely online teaching and learning context and communicating asynchronously and synchronously using mathematical language and notation.

Keywords: Online tutoring, asynchronous, synchronous, mathematics and statistics support

Introduction

As part of a suite of initiatives to mark the full-scale operation of the Mathematical Education Support Hub (MESH) at the University of Western Sydney (UWS), the online mathematics and statistics tutoring service was introduced in early 2013 to a small cohort of first level students enrolled in quantitative units. The service's launch followed a period of investigation of suitable service models and research studies examining similar support offerings and their various teaching and learning and technological dimensions, as well as experimentation with asynchronous and synchronous communication technologies that would underpin the UWS offering. This paper puts forward for consideration some of the discoveries made and challenges encountered throughout these preparatory implementation stages.

Issues

Among a range of operational and technical issues affecting the use of the online tutoring service, the authors have chosen two for discussion in this paper – pedagogical considerations and the use of mathematical notation in asynchronous/synchronous teaching and learning spaces. The pedagogical opportunities and constraints enjoyed by teachers working with quantitative learners in purely online spaces are manifold. In this section a contextualised account of some of the peer-reviewed discourse addressing this broad topic is given, followed by a reflection on the authors' practical experience.

Pedagogy

Alongside the technical elements of the development of the tutoring service, an important element was preparing the service's teaching staff for the extraordinary pedagogical issues that moderating a discussion forum or 'virtual classroom' might present. This involved considering the similarities and differences between conventional face-to-face teaching and learning dynamics and those experienced through asynchronous and synchronous online communication. Once identified, these were used to motivate discussion about how to translate pedagogy from the conventional to the online setting in the case where similarities existed, or transform it in the case where differences were found.

A range of recent studies investigating online teaching and learning practice were used as a starting point and inspiration. Some of these examined pedagogical issues in both asynchronous and synchronous spaces, while others focused only on the latter.

In their paper 'Virtual Spaces: Employing a Synchronous Online Classroom to Facilitate Student Engagement in Online Learning', McBrien et al. examine various teaching and learning issues in a synchronous higher education teaching space (McBrien et al., 2009). They use Moore's notion of transactional distance to frame their discussion in terms of three theoretical elements: Dialogue, Structure and Leaner autonomy (see Moore, 1993).

In the case of Dialogue, they note the advantages of synchronous environments with regard to improved student participation:

> Many students linked dialogue to important pedagogical considerations… such as increased participation and increased time to reflect before responding. Perhaps most importantly, the synchronous online platform allowed students, particularly shy students, to feel more comfortable expressing their opinions. This indicates the power of a synchronous online system to empower students in conversation and expression. Many of these students may never initiate comments in a traditional classroom. In such cases, the transaction distance enables such students to formulate their ideas and receive responses to them, thus increasing their learning potential. (p. 13)

But they also note that that this can come at the expense of students feeling 'confused' by over-exposure to simultaneous, multi-channel communication systems. With regard to Structure, the authors note that 'students revealed the need for clear and consistent structure, expectations, and roles in virtual classroom sessions to reduce their experience of distance' (p. 14). And with Learner Autonomy, they suggest that technical complications can be a strong force for student disengagement.

These themes are echoed in Michael Jopling's review of one-to-one online tuition in schools and higher education (Jopling, 2012). Using 17 'core studies' and a grounded theory approach, the author identifies four dimensions of 'next practice pedagogies' that epitomise innovation in online tuition.

The first of these, 'relevance', concerns teaching approaches that weave digital literacy instruction into the curriculum, in addition to providing opportunities for authentic learning (using external professional mentors, for example), the growth of trusting, possibly informal, relationships with students and the expert use of paralinguistic and non-verbal online communication. The second, 'co-construction', considers approaches that allow students to 'lead, negotiate and own their learning' (p. 315). Sub-themes are the promotion of learner autonomy and empowerment via self-directed enquiry or peer-to-peer tutoring. The third, 'learner-tutor mix', covers issues relating to teachers' changed (or even threatened) status and identity in learning environments that lend themselves to facilitated collaboration, integrated (student-teacher) digital expertise, lesson negotiation and skill enhancement. The last dimension, 'in and out of school/HE contexts', concerns 'pedagogies that seek to remove the boundaries between learning in and out of school, university, and other educational contexts, and support the learner in making connections between different learning experiences' (p. 316). An important sub-theme here is the need for dedicated and reliable technical support for teachers and students, 'particularly outside their educational institution' (p.317).

A number of pedagogical challenges in the synchronous setting are discussed from the tutor's perspective in 'Web conferencing for synchronous online tutorials: Perspectives of tutors using a new medium' (Kear et al., 2012). Issues examined include: the unpredictability of real-time teaching and learning environments (where teachers need to 'adapt their responses to learners' responses and needs' (p. 954), and where, crucially, this is not always aided by non-verbal communication; the difficulty of adapting material prepared for face-to-face tuition to lessons suitable for synchronous online instruction; enabling and encouraging students to speak during web conferencing sessions, and striking the right balance between the spoken contributions of the tutor and that of their students; participants' ability to input and edit mathematical notation while maintaining the flow and momentum typical of well-functioning face-to-face interaction; and negotiation of complex, multimodal interfaces.

Due to the relatively small-scale nature of the pilot discussed in this paper, the experience of the authors, who were the sole moderators of MESH's online tutoring system, was limited to use of only part of the system: the asynchronous discussion forum. (It is expected that, with the inclusion in the program of many thousands more students in the second half of 2013, the synchronous part will soon play an important role.) This forum was open to all students enrolled in at least one of five first level mathematical and statistical units; and it was designed in such a way that it could articulate with a 'virtual classroom' if students required real-time assistance beyond – or as a substitute for – their delayed-time interactions with its moderators. A selection of questions and issues that arose for the moderators is given below:

- In what ways does the delayed-time interaction in a vUWS discussion forum affect the character and quality of the teaching and learning process? Due to the html-based nature of the vUWS (i.e. Blackboard Learn) discussion tool, some effort was required to ensure that posts were not overly 'text dense', and that, in particular, they had a well organised, readable and visually appealing or instructive style. This usually involved the use of embedded graphics files or photos of handwritten calculations or diagrams. A disadvantage might be the lack of interpersonal dynamism and conceptual 'wayfinding' that often characterises real-time interaction. Serendipitous discovery and opportunities for socially-constructed learning might also be compromised in the absence of instant or immediate two-way communication, as might opportunities for 'nipped-in-the-bud' correction of learners' misconceptions. Advantages might include the fact that delayed responses allow teachers and students to properly digest information given to them and to carefully craft replies. Peer involvement in the question and answer process might also be more manageable and rigorous (from the moderators' viewpoint) in cases where moderators have time to intervene and correct or extend 'solutions' volunteered by students;
- How should the moderator position themselves in the asynchronous space? Should they be discipline experts or 'final arbiters' who provide definitive advice on matters of content? Or should they occupy the space 'lightly' and allow room for informal, experimental or speculative modes of instruction? And in what ways is the nature of the dialogue between teachers and students affected in each of these cases? (One of the authors admits to having felt some pressure to make every response to student questions authoritative and mathematically precise, knowing that an unseen audience of learners might be reading them.);
- What expectations might the students have with regard to turnaround time for their posted problems? How should these be managed in cases where students require rapid resolution under threat of their query becoming irrelevant (e.g. where they require help with an impending assessment task) or the need for reasonable levels of instructional continuity and steady or well-paced development towards a satisfactory answer?
- Should students be provided with a complete 'one off' answer to their query or might their asynchronous learning be more productive in the case where the moderator uses prompts, hints, partial or parallel answers in order to offer a gradual unfolding of the solution? In the very early phase of the pilot, one of the authors adopted the former approach, while the other adopted the latter. Both eventually agreed that dialogue-driven or cued interaction with students was preferable pedagogically – though the question of how the learning materials generated might be reused in an FAQ or searchable repository remains open.

Mathematical notation

In 'Communicating Mathematics on the Internet: Synchronous and Asynchronous Tools', the authors highlight the challenges associated with displaying and manipulating mathematical notation on the internet. They cite studies that posit these challenges as the reason why 'mathematics courses have been less prevalent than courses from other content areas to move online' (see e.g. Engelbrecht & Harding, 2005). Hodges (2009) refers to the difficulty of communicating online with mathematical notation, noting that – to borrow Hodges' and Hunger's phrasing (Hodges & Hunger, 2011, p. 40) – this is 'severely hindered by the state of the tools available to author such content'. Various mark-up systems are cited as solutions to this problem, including MathML and LaTeX via specialised graphical user interfaces that minimise the need for code-based editing.

The authors of 'Diagrams and math notation in e-learning: growing pains of a new generation' refer to the 'extraneous cognitive load' imposed by 'unnecessary steps in the communication process' that are caused by insertion of special mathematical symbols into online postings (Smith & Ferguson, 2004, p. 682). They also note the need for online instructors to be able to put maths notation directly into threaded discussions (rather than as file attachments or links) and to be able to draw 'quick conceptual sketches' without losing the thread of a discussion (p. 683). An interesting distinction is drawn between MathML notation which 'retains its semantic mathematical meaning' (and can therefore be used as input text for graphical or scientific applications) and other rendering modes, such as the Java-based WebEQ, which cannot readily serve this computational purpose (p. 685). A solution to the problem of disjointed 'symbol-insertion' methods of mathematical communication is a virtual whiteboard that allows for combined use of symbols accessible via graphical user interface menus and freehand text rendered via a text or pen tool.

This paper's authors anticipated that many students would use standard keyboard characters to denote mathematical or statistical elements in their vUWS discussion posts – even though the Blackboard Learn discussion tool offers a comprehensive selection of special characters such as Greek letters and cups and caps for set union and intersection. Hence moderation of the forum required facility with 'shorthand' characters denoting operations such as multiplication (* in place of ×) and mark-up such as subscript and superscript (x_1 and e^2 in place of x_1 and e^2). Students were directed to a web resource that itemised these and other such shorthand denotations. Where relevant, the authors embedded image (jpg), Word or LaTeX (PDF) files to fully furnish diagrams or calculations with annotated text.

In preparing for use of the 'virtual classroom', the authors explored the various whiteboard tools within the web conferencing system Blackboard Collaborate. While the synchronised, multi-user facility of the whiteboard allowed for 'collective' student interaction (Lissaman et al., 2009, p. 219), and enabled seamless integration of 'diagrams, formulas/math notation and text' (Smith & Ferguson, 2004, p. 684), it was awkward to write or draw on using ordinary computing technology such as a mouse or laptop touchpad. (Both authors made use of graphical tablets which significantly improved their dexterity with the whiteboard tool.)

Questions and issues that arose for the moderators are given below:

- What expectations can teachers have with regard to students' confidence and competency in using shorthand characters to denote mathematical symbols or widgets, interfaces, applications or tools that enable the use of sophisticated mark-up? How should students lacking skill in this area be inducted into online mathematical communication?
- Are there any mathematical language conventions or modes of expression that are qualitatively different in an online setting as compared to a face-to-face setting, and how can these be organised and made uniform and/or rigorous?

Conclusion

By considering the research base relating to (mostly) higher educational applications of asynchronous and synchronous communication technologies, the authors prepared themselves for the implementation of an online mathematical and statistical tutoring service. The pedagogical and mathematical notation issues examined in this paper informed the development and delivery of this service and acted as a useful reference against which the early implementation experience could be contrasted and compared.

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Enhancement of scientific research and communication skills using assessment and ePortfolio in a third year Pathology course

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Abstract
While science students are often aware of their gain in scientific knowledge through their degree, the same cannot be said for their understanding of their development of generic skills. Often, such development is tacit, both for the students and the staff teaching them. ePortfolios have been used to address the important issue of professional skills building and career preparedness for undergraduate science students in several courses across two degree programs. This report focuses on a third year Pathology course, *PATH3205 Molecular Basis of Inflammation and Infection*, taken by students who typically focus on pathology at the University of New South Wales (Sydney, Australia). The overall teaching, learning and assessment strategy requires the students to engage in the use of an ePortfolio as part of their reflective learning process in developing life-long and life-wide skills in research thinking and writing which underpin research-intensive activities. The Mahara ePortfolio application was made available via Moodle and linked explicitly to a series of assessment tasks associated with current research activities in pathology. The study documented the responses of students to the use of ePortfolios and related learning activities, through both the recording of acquired skills and emerging understanding of the student perceptions of themselves as professionals from a generic skills perspective. These skills are ultimately transferable into professional scientific careers. This study was designed to further inform

the development of reflective practice, enhancement of generic skills and career awareness and readiness in a program-wide implementation in Medical Science and Advanced Science. Through that implementation we hope students will better understand their present and imagine their future.

Key words: Mahara, ePortfolio, Moodle, medical science, reflection, communication skills, research skills

Literature review

An ePortfolio is "a digitised collection of artefacts including demonstrations, resources, and accomplishments that represent an individual, group, or institution" (Lorenzo & Ittelson, 2005). It can be a digital repository for a range of learning materials, including those produced for course-based assessment such as videos, images and text based reflections and use any form of digital cloud space, such as Google Apps or developed spaces such as Mahara or PebblePad. ePortfolios have developed further from this repository of learning materials into personal digital spaces, student-centric monitors of learning across disciplines to document learning and put the student in a position where they can take charge of their own learning (Butler, 2006) through the selection of the artefacts for view or presentation to selected audiences. As ePortfolio presentations are planned and curated by students rather than by the educator, they start to play an active role in developing life-long skills of reflection and selection for students. ePortfolios are found in many areas of higher education from assessment to career development and provide evidence of acquired graduate capabilities. This reflection on learning has been found to facilitate both life-long and life-wide learning that enables the learner to comment on their collection of evidence (Cambridge, 2008).

The use of ePortfolios in Australian higher education is characterised by portfolios for learning, assessment, reflection (Abrami & Barret, 2005; Barrett, 2005; Barrett, 2006) and for professional development and graduate recruitment (Hallam et al., 2008; Leece, 2005). These studies have indicated that the development of an ePortfolio for learning and assessment is supported by the life-wide approach to the technology as students ‘take’ their learning with them after graduation, beyond assessment submissions, as a career development tool (Leece, 2005). ePortfolios can transform and enhance the curriculum and demonstrate to students and educators the connections between their learning, assessment criteria, program outcomes and graduate capabilities (Barrett, 2005). This clear alignment of assessment with learning outcomes encourages students to document their learning and consider how the course assessment relates to the program of study and how it can be used beyond the course, as a digital repository or collection space. ePortfolio thus constitutes a form of sustainable assessment as it enables students to present themselves in a number of ways, to a number of audiences, empowering them as learners in many instances.

The Role of Reflection, ePortfolio, Professional and Career Development

Recently in higher education, there has been a growing imperative to have a portable record of work undertaken across a number of areas of responsibility in a student’s academic life for assurance of learning. An ePortfolio serves this purpose and several important functions with this in mind; it records past and current practice, provides opportunities for reflection upon practice to effect change, and acts as a change agent by enabling long-term ongoing evaluation of student performance and associated learning outcomes.

Career development learning, professional readiness and ePortfolios

Career development learning (CDL) is a process that “empowers individuals to identify, develop and articulate the skills, qualifications, experiences, attributes and knowledge that will enable them to make an effective transition into their chosen futures, and manage their careers as life-long learners, with a realistic and positive attitude” (Stanbury, 2005). It is both a trans-disciplinary process and a subject discipline with its own history, evidence base, theoretical frameworks and methodologies.

The goal of CDL is to help students to acquire knowledge, concepts, skills and attitudes which will equip them to manage their careers, therefore their life-long progression in learning and work (Watts, 2006). Although there are different theories and developmental approaches to careers education, the most widely used framework by career centres around the world is the ‘DOTS’ model (Fig. 1). The basic assumption underpinning this model is that effective career learning is composed of a dynamic relationship between Self, Opportunities, Decisions and Transitions (DOTS) (Watts, 2006). These four elements involve:

- Self-awareness - the ability to identify and articulate motivations, skills, and personality as they affect career plans
- Opportunity awareness - knowledge of opportunities and the ability to research these
- Decision making - being able to weigh up personal factors to make a sound plan
- Transition learning - understanding of how to seek and secure employment opportunities.

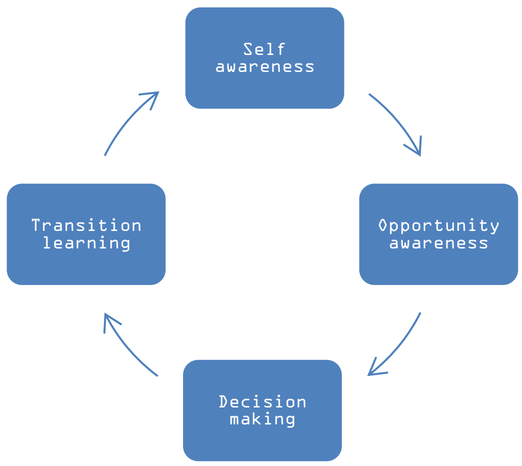

Figure 1: Decision Making, Opportunity Awareness, Transition Learning, Self-awareness (DOTS) model

These stages build iteratively upon each other so, ideally, a student moves through the cycle more than once during their course and is afforded the opportunity to do so.

As CDL requires the student to undertake self-assessment and perform an appraisal of the context of their learning in relation to their discipline, it lends itself to learning and teaching methods that require reflection (McIlveen et al., 2009). Boud, Keogh & Walker (1985) suggested that reflecting on learning is said to transform experience into learning as it allows opportunity for the student to reassess an experience and make decisions on how to change or improve on the learning outcomes. As Boud (2000) recommended, it also enables students to:

- identify their learning
- make judgments about their learning
- prepare them for learning

An ePortfolio enables students to document their journey through the DOTS model cycle. It is a space where they can collect their experiences, reflect on the connections between theory and practice and present evidence of development of their graduate attributes, so that upon graduation they are well situated to make a successful transition into their chosen employment.

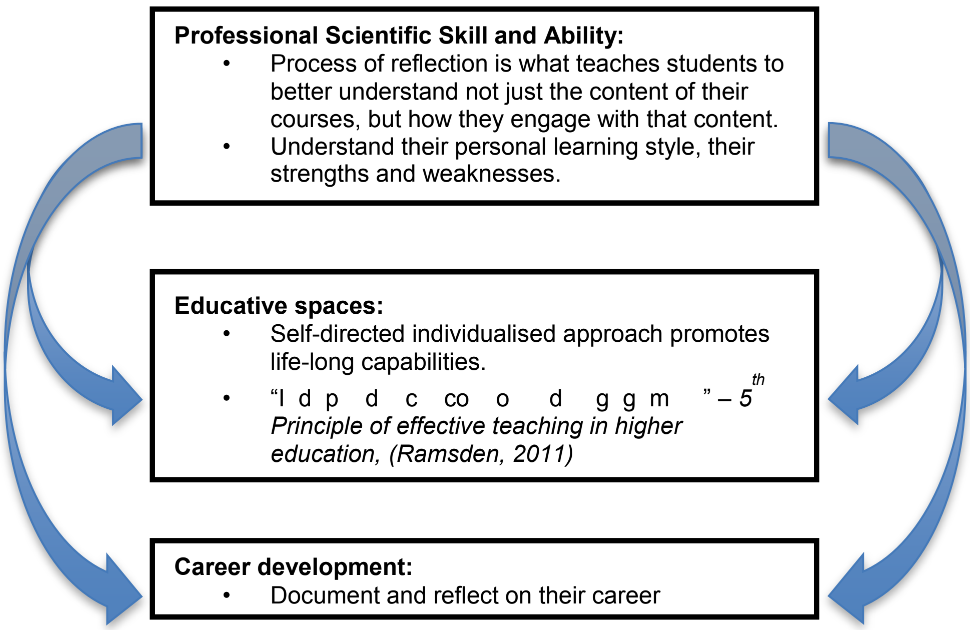

Figure 2: ePortfolio pedagogy and technology cycle

Study aims

This pilot study sought to engage 3rd year students, who are, for the most part, undertaking the Medical Science program, in reflection upon the relationships between their educational experiences in core courses, their personal and professional development, future career aspirations, aptitudes, and opportunities. The project focuses on making explicit the more tacit and deeper outcomes of developing an ePortfolio and highlights the interrelatedness of learning processes, knowledge and skills that the student gains throughout a science degree program. This study further sought to address the principal aim of exploring the often tenuous relationship in higher education between 'hard' and 'soft skills'.

Program-wide context

The development of this project arose through the combined interests of teaching-research academics and career advisors at UNSW. Together we have identified opportunities to address the UNSW Graduate Capabilities through skills development and the introduction of ePortfolios (Fig. 3). This particular study is appropriately staged at Year 3 such that near-graduates, who will have developed professional skills and need to develop career pathway awareness, begin to reflect on their transferable and technical skills acquired throughout their undergraduate studies and address any weakness that might hinder their ability to achieve their career target. Together, these elements can help fortify student professional skills and career awareness by encouraging students to consider their developed skills and capabilities, work interest areas, career paths and decisions, employment opportunities and attitude for career success.

It is not enough, in times of evidence-based education practices, for students to claim at the end of their programs of study that they have achieved capabilities of scholarship, leadership, professionalism and global citizenry (Fig. 3). They are now required to substantiate such claims with clear records of achievement. ePortfolios offer the perfect opportunity to both record and enhance professional skills and tailor them to the workforce in which graduates will practice. Further, use of ePortfolio as part of the formal curriculum, through assessment, will enable the University to warrant, by proxy, claims of its graduate capabilities through the students' own acknowledgements of achievement. This is particularly important when, at the Program level, it is difficult for the institution to provide such warranty.

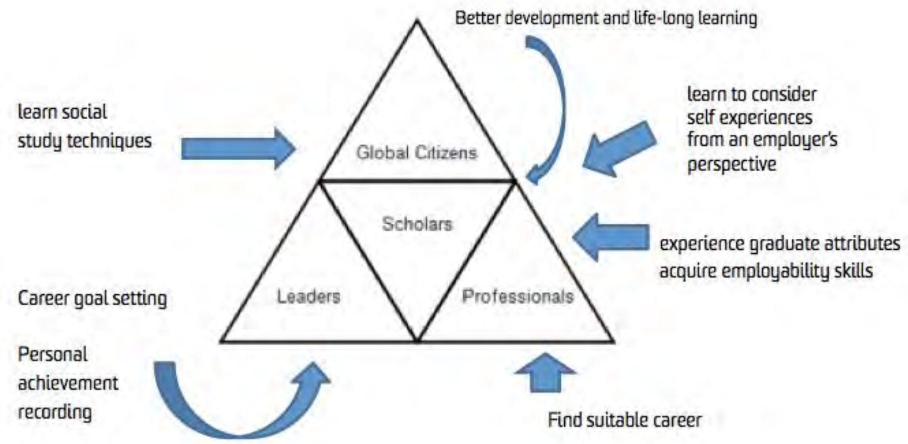

Figure 3: Demonstration of graduate capabilities and employability skills using an ePortfolio

In 2012, the Mahara ePortfolio platform was implemented to address the above-mentioned issues, as an extension to an ongoing pilot of the Moodle learning management system at UNSW. Mahara ePortfolio was introduced into a range of courses across the Advanced Science and Medical Science programs. Mahara was implemented in the Medical Science program from stages/years 1-4 in order to begin addressing a program-wide approach to skills building, professional readiness and career awareness. In Year 1/Stage 1, Semester 1 SCIF1111 *Perspectives in Medical Science* & SCIF1121 *Advanced Science: Professional Perspective and Practice* Mahara ePortfolio was applied to stimulate and record reflective practice, professional practice (skill development/enhancement) and to encourage greater connection with and between curricular elements. In Year 2/Stage 2, Semester 2, PATH2201 *Processes in Disease* /PATH2202 *Processes in Disease for Health and Exercise Science*, Mahara was introduced to further develop skills in reflective practice and writing. In Year 3/Stage 3, Semester 1, PATH3205 *Molecular Basis of Inflammation and Infection*, the focus of this report, the use of Mahara ePortfolio aligned with development in written and oral communication research skills, while in Year 3/Stage 3, Semester 2 PATH3208 *Cancer Sciences*, the alignment was explicitly with career readiness, to be continued in Year 4/Stage 4 School of Medical Sciences Honours in the Advanced Science and Medical Science degree programs.

Study design

Course focus

The course *PATH3205 Molecular Basis of Inflammation and Infection* is a Stage/Year 3, Semester 1 subject offered to students across a range of degree programs across the Faculties of Science and Medicine at the University of New South Wales. This course was chosen as it has a wide breadth of authentic assessment tasks and is a key semester 1 course for the Pathology specialisation in Year 3. Two key assessment tasks, a research laboratory report and a research team presentation, were used to facilitate development of professional skills in written and oral research communication and career readiness in medical research, as part of the program-wide pilot study in the Medical Science degree described above (Fig. 4).

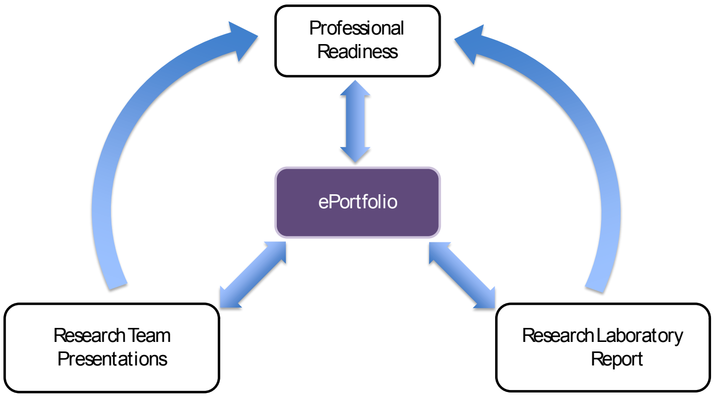

Figure 4: Professional skills development through authentic Aasessment and reflection using an ePortfolio

Teaching and learning strategy

Students in PATH3205 attend lectures, which focus on the most recent research advances in molecular medicine, and then participate in workstation-based laboratory workshops, demonstrating 'state-of-the-art' molecular techniques that are key in disease diagnosis. Students are then assigned one of the research topics and asked to prepare a research laboratory report, documented in a standard scientific format: Introduction, Hypothesis, Aim, Methods, Results and Discussion. Students write up all eight topics in their ePortfolio and produce one full report. Students, in groups of 4-5, are also given a Pathology topic that they have to research, prepare and then deliver as a 15-minute presentation (including questions). As a team-based activity, all members must be prepared but only one delivers the presentation, the others having to answer questions. There is review of the presentation, including the ability to answer questions, by peers and academics, using an instrument in class, with a focus on content. Group membership is assigned on prior academic performance to provide balance within groups.

ePortfolio use and rationale

Students were asked to use the Mahara ePortfolio to document: 1. a narrative around the learning process shown through the research laboratory lectures and workshops, 2. demonstrate engagement, in a reflective manner, with that process, 3. build an awareness of their skills development, understand subject-related skills, personal values and relevance to their professional future, and 4. recognise strengths and weaknesses of the research laboratory and team presentations. The use of a digital portfolio space in this course encouraged these students to document and demonstrate their learning by building awareness of transferable and technical and professional skills required for different research areas in the field. The laboratory report writing task is authentic to research practice and offers a real world experience; it also allows students to think and write as reflective practitioners in determining their personal values, work experience, and strengths and weaknesses, through self-reflection upon learning across the many research laboratories and techniques presented as part of the PATH3205 course.

Study Outcomes

Our findings indicate that 3rd year medical science students engaged with the ePortfolio and used it to develop their reflective practice. The use of ePortfolio demonstrated that students could interrelate their learning process of content and research communication skills development, the integration of 'hard and soft skills' through the abovementioned assessment tasks. While exemplar quotes are provided below, more extensive excerpts have been included as Appendix 1. Entries in ePortfolios highlighted a range of the desired outcomes of the course and its processes, including skills development, particularly around research;

> Overall, this research lab was helpful because it helped me think through the advantages and disadvantages of the different [research] models that are commonly used in scientific research. It also helped me to develop my problem solving skills as we were encouraged to think through how we might go about investigating a question in regards to asthma.

perception as professionals;

> As an aspiring doctor that is always trying to improve my interpersonal skills, I really saw the value in this research assignment. The ability to be able to work in a collaborative group is also crucial to research and I feel this project helped develop those skills.
>
> This informed my perception of research by extending my definition of research as gathering and synthesising relevant sources, and a continual process of self-reflection and asking questions, to obtain answers, which generated further questions. This project allowed me to think more about conveying the information I had helped to gather, as well as the idea of working as a team cohesively, supporting each other… and utilising the skills and abilities of our group members.

and career awareness;

> I think this ultimately gave me a deeper understanding of the content. Also gave me something to show potential employers.

Survey and results

The survey tool was primarily career-oriented and considered to be appropriate to the Program-wide study. It was administered in Weeks 1 and 13 of semester, representing 'entry to' and 'exit from' the PATH3205 course. The items covered in the survey can be seen in Figure 5. Survey data were obtained prior to commencement of any course activities and pre-ePortfolio use (Fig. 5, blue bars) and upon completion of the core assessment tasks described above (Fig. 5, blue + red bars). The entry and exit data series were analysed for statistical difference using the IBM SPSS Statistics 21 package; difference was considered significant at $p<0.05$. Our data shows that students significantly improved in self-confidence in areas relating to knowledge of degree-specific (technical) and transferable (non-technical) skills. Notably, students demonstrated a 12% improvement in self-confidence in knowing degree-specific skills ($p=0.001$), suggesting that the linkage between content knowledge and important technical skills covered throughout the course is made explicit and this is also reflected in the course-oriented contributions in Mahara ePortfolios. Students also demonstrated a significant enhancement in knowledge of transferable skills ($p=0.021$), indicating that the use of Mahara ePortfolios improved insight into the transferable generic skills gained throughout the course. Interestingly, students also showed significant increase in self-confidence in areas relating to career awareness, items 6 ($p=0.003$), 7 ($p<0.001$) and 16 ($p=0.005$). While not part of the formal curriculum, it is speculated that raising such topics through the survey itself, or coverage of career-oriented topics in other courses, or participation in extracurricular activities, may have led to these effects; the basis for this change needs to be investigated further.

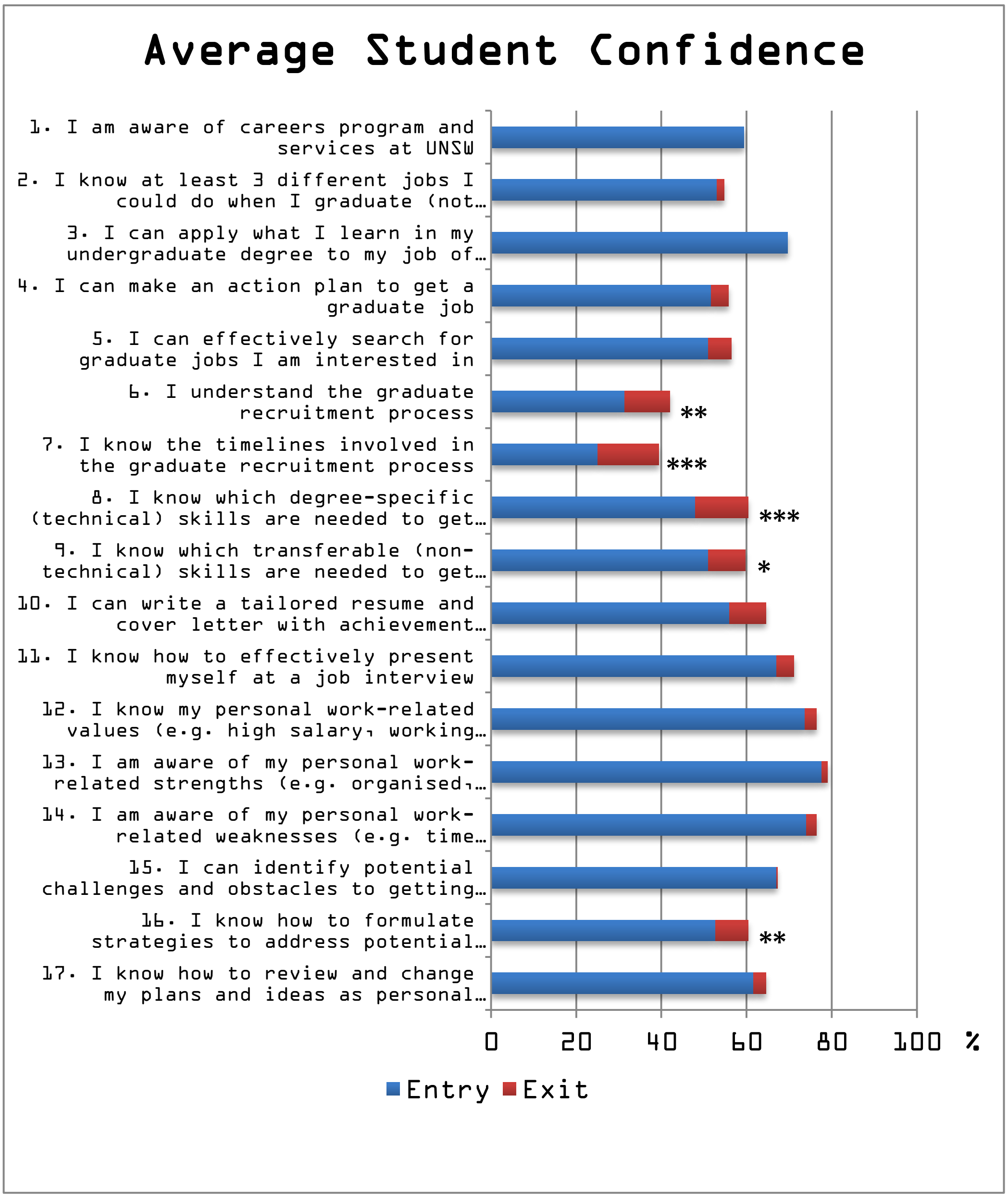

Figure 5: Improved confidence in technical skills, career awareness and professional readiness in PATH3205 students

Discussion

Although Medical Science and Advanced Science students typically perform well academically, these students are often less conscious of the need for professional skills development. We showed in this study that the use of ePortfolio for reflective practice to improve student awareness of degree-specific and transferable skills through regular documentation of learning processes supported and improved student-learning outcomes of graduate capabilities, as highlighted in previous studies (Abrami & Barret, 2005; Barrett, 2005; Barrett, 2006). A key goal of the course considered in this study aims to improve graduate written and oral communication skills in the research context, through authentic assessment (Boud, 2000). Our study outcomes demonstrate that ePortfolio appears to be an effective and sustainable tool in helping to achieve this goal. Although the use of digital portfolios in creative industries is commonplace, this study provides novel evidence for ePortfolio implementation to enhance research and communication skills in science in higher education. Moreover, our study revealed that the use of ePortfolios helped improve student consciousness in their development of perception as professionals and career awareness, as described by others (Leece, 2005).

The use of ePortfolio in PATH3205, aligned with authentic assessment tasks such as research oral and written communication skills, serves the purpose of recording past and current practice, and enables long-term on-going evaluation of students' own performance and associated learning outcomes. Students in this course were able to make connections between course content that was taught and the application of these concepts in future studies and work. ePortfolios as educative spaces enable both a self-directed and an individualised approach to learning that can promote life-long capabilities and can enhance students' professional preparedness in Science by approaching the learning experiences through an orientation of process rather than product (Loughran & Corrigan, 1995). Similarly, we found that students became more career conscious through creating their own ePortfolio, even though this was not part of the formal curriculum. As these students engage in this reflection upon the relationships between their educational experiences in this course, they showed awareness of both personal and professional future career aspirations, aptitudes, and opportunities. As students develop the appropriate skills and confidence to self-regulate their learning and become responsible for their learning, they can engage both individually and collaboratively in the ePortfolio (Dornan, Carroll, & Parboosingh, 2002; Grant, Kinnersley, Metcalf, Pill, & Houston, 2006). This highlights and makes clear the inter-relatedness of learning processes, knowledge and skills that the students gain across a program, thus providing opportunities for students to reflect on their practice and how this has resulted in their development of graduate capabilities and career preparedness (Orland-Barak, 2005; Wade & Yarbrough, 1996).
The Australian Government has become increasingly concerned with the development of work-ready graduates. Therefore, as stated in the Australian Qualifications Framework (AQF), the Threshold Learning Objectives (TLOs) represent what a graduate is expected "to know, understand and be able to do as a result of learning." Such standards have been developed for Science and are currently being contextualised for other disciplines (Australian Learning and Teaching Council, 2011). The ePortfolios presented by students in this study demonstrate that it is an encouraging method of promoting skills development and awareness in university students, thereby aligning with the goal stipulated by the AQF to equip graduates with relevant skills for employment. In addition, Australian universities are also currently looking for ways to enhance students' knowledge and the application of that knowledge through self-initiated mechanisms (Botterill, Allan, & Brooks, 2008). As a proof-of-concept, this study also shows that the integration of ePortfolio into course curriculum and assessment, as a self-regulated resource, provides a suitable solution in addressing this concern and allows educational institutes to demonstrate student knowledge and capabilities.

Future considerations

The research showcase activities can be refined, with less but more carefully selected representatives of current research, though choice is driven somewhat by program-level curriculum, and the need for balance between reinforcement of concepts in different contexts, and repetition, and perhaps a better balance between theory and application/context. There is a need to make more explicit the processes in teaching and learning activities, particularly those relating to skills, such as the experience of collaboration. This is likely to drive better outcomes with respect to the recognition by students of these skills and the importance of these skills in the professional context, particularly in a research environment. Certainly, the process of student reflection provides, in effect, student feedback, thus informing curricular development. The next iteration of the course may see the introduction of peer review, associated with use of paired reports, the first report serving primarily as a formative activity, scaffolding the production of a second, more highly weighted, primarily summative report. Peer review or support could also be employed to enhance the production and quality of the ePortfolio. The use of peer review would align at the Program level, given its extensive use in the Year 1 SCIF courses (Cox, Posada and Waldron, 2012) that, for most students, precede PATH3205. Thus, the integration of our pilot studies using ePortfolios in other science courses from years 1-4 at UNSW along with PATH3205 ePortfolio use in Advanced Science and Medical Science at UNSW provides a cohesive Program-wide approach to achieve these important learning goals. Furthermore, this Program-wide approach of using ePortfolios can be implemented at other Australian universities that offer science degree programs.

Significance and Conclusion

The science degrees in which this course is taken may be considered foundational in that many career pathways can be taken upon completion. These pathways include: further studies in postgraduate education including Masters and PhD programs in research – basic, clinical or industrial research and development, post-graduate professional degrees offered as postgraduate programs including Medicine, Dentistry and Pharmacy; or other non-traditional scientific areas – technical support, sales, marketing and communications. Whilst these students are academically successful, many are unaware of the skills they are developing and/or pathways to achieving career success available to them after the completion of their bachelor degree. The hope is that the use, across an increasing number of courses, of reflection, facilitated through an electronic environment such as that afforded by Mahara, along with appropriate teaching and learning strategies, will continue to support students in their professional development and their awareness of their own career readiness and pathways.

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Appendix 1 – excerpts from Mahara eportfolios

Student A, page 1

In which I attempt to make sense of everything I've learnt in the research labs.

Hepatitis C Research Lab

Maybe because it was our first lab for the series, and because we were still fresh into the new semester and were excited for the first lab of PATH3205, that we find the lab quite a disappointing one. All I can think of as a reason is perhaps we were expecting something new in pathology, where we actually get to do an experiment manually, even though we should have known what to expect (it's pathology, of course) in terms of "laboratory work" in a computer lab room.

In this lab, we have investigated...I'm not sure exactly what we have investigated, that's the thing. I know that we were looking at HCV...epitopes? We had to access a database and put a bunch of numbers and other stuff in as the superviser instructed, and then we get a bunch of numbers and letters given back to us by the database...

I've never come across ELISpot before, but my understanding of what we use it for is to measure levels of reaction by the lymphocytes when exposed to a particular Hep C virus epitope.

Experiments are a lot harder to interpret especially if you didn't perform them yourself.

Asthma Research Lab

I really wasn't sure if the lab had been an easy one to follow or a difficult one. I took heaps of notes during the lab, understood why there needs to be a separation between the different models which can be used in a lab setting, how ELISA works (I think. I don't remember exactly what the difference is between the antibodies used and why they need to be different) and how it is different from immunohistochemical staining. I understood everything but still couldn't see how it all fits into a picture. So I received mixed feelings about this lab.

But I really enjoyed the group discussions on the different ways experimental models can take form. I've always known experiments are tedious, but I appreciate this new understanding I have and was glad to be given the opportunity to learn. I am more aware now that science isn't just applying chemicals to culture plates or inducing diseases in mice, they have been designed in a way, taking other factors into account so that hypotheses can be tested in the best possible way.

Maybe it's the fact that the disease in focus (or rather, disorder) itself doesn't have clear-cut answers.

Maybe it's actually the fact that as a perfectionist and as a student, I expect answers to be given to me right away.

As a budding scientist, to come across something that is largely unknown is supposed to be a cause for celebration. Like, *yay there is something for me to further investigate out there*, because hey, everyone by now knows that the earth is round, that the sun rises in the east etc etc etc. Asthma is supposed to be one of those areas where there is room for more discovery. It still comes as a huge shock to me because I thought with the prevalence of asthma it would've been a well-established disorder, no mysteries.

Of course asthma is't so common where I've come from. But having lived in Australia for quite sometime now I really thought answers would have been ready for me as a pathologist to receive. It turns out that my generation will have to do some more in this area (this is assuming that I will actually be involved in it in the future) (wistful thinking FTW)

エトセトラ

Being the chronic procrastinator that I am, I made this keep-calm-and meme on a day where I was supposed to study for Pharmacology. Yeah, maybe I will make one for that subject too. Later. Too lazy right now.

Student A, page 2

The research assignment for PATH3205 had been the most successful team assignment I've had in my three years of uni career. I've never really hated working in groups, but I can never say group assignments are my favorite type of assessments because the success depends on the personalities which make up the group. Ok, maybe this unpredictability is what pisses people off most of the time because not all of us get to be assigned with people we like, or at least people who care about their marks as much as we do to want to put the same amount of effort as us if not more.

Coming back to the research assignment, I was put in the same group as a couple of other students whom I've come to know over the years but whom I wasn't very close with. We had been assigned Wegener's Granulomatosis, and on top of that we had to present on the first week for the research series. The thing about the assignment is that for a 10 minute presentation only one person will be picked by random draw...Which calls for every member of the group to come prepared on the day of the presentation.

This was how my group became close. We met once to twice a week in the library, teaching each other what we do know and then stressing over the information overload by the end of the day. It was actually kind of fun, because within our group we treat each other as equals and we all try and give feedback in the most respectful way. There was no issue as to who gets to be the "dominant" one or who actually does the most work, We've all put the same amount of effort in. We initally had a bit of a disagreement over the use of Prezi for the presentation as opposed to just the traditional power point...And we were the only group in the course to have used Prezi... (I have the feeling our mark got dragged down because our visuals gave the audience motion sickness but oh well) but in the end everyone had fun contributing to the preparation the minute we all agreed to just go forth with what we had.

This assignment made me realize that as I pursue my career further in a research setting team work will have to be something which should come as second nature. And this will be challenging because by then my team will be aiming for something that is beyond a university assignment.

Student B

Overall, I found that this lab report was very challenging and hard to write, due to the word limit (1000 words). The content of the lab, and the lab itself are easy to follow and highly detailed, but it is because of this detail that makes this report a challenge to put together. What I have written up in the report only consisted of one part of the lab (1 out of 3 stations), and already it is pushing the word limit. I would have liked to be able to go into some detail on some aspects of the lab (and had found several good articles and points which I had to unfortunately cut out), and also it would have been nice to be able to include Stations 2 and 3, which are more focused on the manifestations of Rheumatoid Arthritis (macroscopically and microscopically).

A lot of the points in my report could have been elaborated on, and I feel quite disappointed that I could not do so, but it was a great challenge finding the right balance between giving enough information and not going over the appointed word limit. 1000 words though is way to little for a detailed report on this lab, and its such a shame, as there are a lot of interesting aspects and details within this lab.

Somewhere in my ePortfolio is a more complete entry on this lab, which was a greater joy to write due to there being no word limit. Overall however, I think I did a satisfactory job writing up this report :)

Student C

This assignment made me realize that as I pursue my career further in a research setting team work will have to be something which should come as second nature. And this will be challenging because by then my team will be aiming for something that is beyond a university assignment.

Student D

In the process of completeing and preparing for our research group project, I learnt a lot about collaboration and teamwork, and what it means to be a researcher.

Student E

Overall, this informed my perception of research by extending my definition of research as gathering and synthesising relevant sources, and a continual process of self-reflection and asking questions, to obtain answers, which generated further questions. This project allowed me to think more about conveying the information I had helped to gather, as well as the idea of working as a team cohesively, supporting each other (contributing and accepting responsibility rather than asking others to do things for us) and utilising the skills and abilities of our group members.

Student F

Working as a group has never been a pleasant experience for me, but this time it went surprisingly well (minus a few bumps and bruises gathered along the way). Everybody in my group had different strengths to contribute, which gave our final presentation a nice well-rounded finish (in my opinion anyway).

Our topic was Hypertrohic cardiomyopathy, which came with a wealth of information available online which took a lot of time to sieve through, but we managed to gather up the main points and incorporate them into a presentation. Each person had differing opinions on what should, and should not have been included into the presentation, and I found that frequent group meetings and discussions were very helpful in resolving this issue.

With presentations, they are very much different from lecture series in my opinion, and are meant to be more engaging and entertaining than a lecture. Personally, I prefer making brief, entertaining presentations, without too much detail, so this was no problem for me :) I do however need to learn to improve on my presentation skills and nervousness- although I wasn't picked to present, I know I would have been too nervous to give a good presentation...

I enjoy being very invloved in group projects, which may, or may not be a good thing. I need to learn to delegate more, be a better listener, and hopefully next group project will be as good a success as this one :)

Student G

We had to think like scientists, and propose possible pathways that led to the formation of the systemic disease. Throughout the course of this project, personally it has improved my communication, leadership and researching skills. We could easily complement each other's strengths and weaknesses, and overall I believe we did a fantastic job at the end.

Overall, this task has enabled me to not only learn new ways on how to research material and information, but also has propelled my characteristics in approaching teamwork and group projects. Such attributes include interpersonal skills that hopefully one day will allow me to become the best possible researcher or doctor I can be.

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Using Twitter in Higher Education

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The use of the social networking tool Twitter was incorporated into a first year education studies course to support the Universities development of First Year students' academic culture, connectedness and resourcefulness. A hashtag was created using the course code where students were encouraged to paraphrase, question and provoke thinking during face to face and individual study time. Student tweets were analysed qualitatively using three types of interaction; learner-learner-instructor; leaner-content & learner-interface. The tweets offer insight into both the social and cognitive engagement of student during their first year of university study.

Keywords: Higher Education, Twitter, active learning

Introduction

An initiative was conceptualised as part of strategic approaches to engage and support student learning and belonging within the roll out of a new Bachelor of Education Primary Program offered across three campuses at an Australian University. The university has a set of directives to guide programs and initiatives for the development of student success and retention. These directives are symbolised through student senses. There are five senses- capability, connectedness, purpose, academic culture and resourcefulness. The initiative was titled- 'Let's Tweet to learn' and was targeted at a student's sense of connectedness in supporting the building of relationships with peers and academic staff; a student's sense of resourcefulness in enabling their ability to access and use knowledge systems, and a student's sense of academic culture in guiding their approaches to study.

Twittering and learning in Higher Education

Twitter is part of the social networking phenomenon of Web 2.0 technologies. Twitter can be thought of as the SMS of the Internet as it allows its users to send and read text-based messages of up to 140 characters. Twitter users post messages, 'tweets', read by users who follow that person or use the same twitter hashtag (Anderson, 2011). A tweet can include text, links to photos or videos and can also be 're-tweeted' for further distribution among followers. In an educational context, tweets can be constructed to express an idea, paraphrase or critique a concept, provide a level of discourse in a virtual space that supports dialogue occurring face to face (Sweeney, 2012). The twitter stream can also provide a record of the event (lecture, presentation, meeting) from the perspective of the participants.

Twitter is a tool that is considered popular with today's students (Taylor & Keeter, 2010) who use technologies as part of their seamless social interactions. Today's students are known by several labels including the 'Millennials' (Oblinger, 2003). These students work and live in different ways. They prefer learning environments that use technology, utilise innovative ‘modern’ techniques, and involve active learning and multitasking (Gardner, 2006).

Universities are responding to these diversifying needs of student cohorts. In support of the Millennials, described by Hilton (2006, 60) as the “born digital crowd”, the notion of what constitutes learning is different than that considered by mature age students. Learning for the Millennial is an active process with students the producers of knowledge rather than gatherers of information. They learn through social interaction and are ‘wired’ or connected to technology as part of their lives. Whereas learning for mature aged students is characterised as a passive, step-by-step process, that occurs in isolation disconnected from technology (McNeely, 2005). These diversified learning styles place greater importance on the need for learning to be accessible 24/7 and having to compete with work, social and family commitments. Catering for these types of learners requires pedagogical shifts in education. Hilton (2006, p.59) describes this shift as the “perfect storm” implying that the nature of learning amongst Millennials are disruptive forces bearing down on higher education, but that these forces should also generate new teaching opportunities. In today’s market, learning is expensive and required on demand. Embedding new technologies into course work suggests a response to the divergent needs for learning and learners.

Stead (2006, p.14) suggests that the best way for an academic to understand the use of new technologies such as Twitter is “to try it out for yourself”, and goes on to claim that “most of the learning for tutors and students can take place on the job”. This learning dynamic where university tutors and students learn together is a new approach within higher education, and one that is being proposed to harness the digital generation (Hilton, 2006; McNeely, 2005; Oblinger & Oblinger, 2005) and to move learning to spaces that are not confined to physical structures such as lecture theatres or workshop environments. Harnessing learning that can occur at anytime or place is about understanding the nature of learning enabled through mobile gadgets such as laptops, digital cameras, phones and iPods. It shifts the focus of learning to the mobile student and brings together global resources of the information world and of learning communities in what Sharpe (2006, p.16) describes as “a more appropriate moment to an individual”.

The use of Twitter in Higher Education is in its infancy (Betrus, 2012). Reuben (2008) suggests that there is great potential in education for the use of social networking tools such as Facebook and YouTube, however, higher education has not yet found the right niche for Twitter. In the domain of health and medicine, Fox & Varadarajan (2011) incorporated Twitter as a way to encourage interaction between students themselves, with the academic teaching staff and with the content of the course. In this instance, tweeting was an assessable item. In a teacher pre-service education course focused on understanding how to use technologies in the classroom, Turcsanyi-Szabo (2011) reported the use of Twitter as an important part of students building a Personal Learning Network. Other studies have investigated live-tweeting during lectures and tutorials (Croxall, 2010; Parry, 2008) while others have examined twittering as a tool to support informal learning beyond the classroom (Ebner, Lienhardt, Rohs & Meyer, 2010; Kassens-Noor, 2012). There is also focus on the students’ social development through the use of this tool such as students getting to know one another, sharing feelings and developing community (Reid, 2011).

Research Context

A newly designed Bachelor of Education Primary program was implemented in 2012. I was the Program Convenor. The program consists of four courses each semester with 420 students across three campuses enrolled in first year. The Education Studies course in which Twitter was trailed was implemented for the first time in second semester. It is a core course and one that involved the students in 13 weeks of lectures and tutorials plus a 10 day classroom practical experience. There was no precedence for course implementation and I was the course convenor.

Mid semester 2012, I attend a study tour in the United States. On this tour I was introduced to Twitter. Having never used the social networking tool before I was intrigued at the opportunities it afforded learning. There were 30 academics on the tour. We used Twitter to share our thoughts on the workshops, events, schools and presentations we attended. It provided us with a dynamic level of interaction for stimulating and extending our thinking. The back channel made our thoughts public. Discourse was active through opportunities for peers to agree or re-tweet posts, add to, question or provide scenarios that related ideas to different learning contexts. In a significant way, the tweets became more powerful than the presentations we were watching, as the discussion occurring between us, in this virtual space, was complex, critical and consuming. Upon return I wanted my students to have the same experience with this tool that I did. I thought this was important for two reasons. Firstly, I wanted the students to engage with Twitter for the purpose of learning rather, to enable critical discourse. Secondly, as a pre-service teacher, they need to be confident with technologies, understand the educational power of the tool and the opportunities it provides for their own virtual presence and learning networks.

I had never used Twitter as a tool in a university course and considered myself a novice. I adopted the approach exposed by Stead (2006) to try it out and learn together with the students. I wanted the students to be active learners as expressed by McNeely (2005) rather than passive recipients in a lecture and I wanted them to experience what I had and to realise that the learning in a lecture comes from what they are thinking about, how they are reshaping what I am saying and how they are relating it to the course content. Learning can be an isolated process in a University. Providing opportunities in which students can make their thoughts known, build on each others ideas, collaborate and co-construct, should empower and benefit all students, even those who are just reading the tweets. I also wanted thinking and tweeting about the course content occurring at any point in time across the week in the lecture, in the tute, when the student was reading course material, when they were seeing something in action. I wanted to encourage tweeting 24/7 so that learning was as Sharpe (2006, 16) describes at a "more appropriate moment to an individual".

Methods

Twitter was implemented to support the University's First Year Experience program specifically to address students' sense of connectedness, academic culture and resourcefulness. The theoretical framework used to analyse course tweets draws upon the types of interactions that occurred through Twitter amongst the students, with the interface and with the course content. The types of interactions espoused by Moore (1989) and Hillman, Willis & Gunawardena (1994) have been enlisted to analyse course tweets and are presented in Table 1. This approach looks at the substance of the tweets for types of interaction rather than the number or quantity of tweets that occurred as part of the course. In this way we can establish if the tweets served the purpose of enabling connectedness, academic success and resourcefulness.

Table 1- Types of interactions and student senses

Type of interaction	First Year Program Targeted student senses
Learner-learner-instructor: interaction occurs between the students, alone or in a group and or with the lecturer	Student's sense of **connectedness** in supporting the building of relationships with peers and academic staff;
Learner-content: interaction occurs when the student intellectually engages with content resulting in changes in understanding	Student's sense of **academic culture** in guiding their approaches to study
Learner-interface: interaction occurs with a focus on the technology as an intermediary between the student and the content	Student's sense of **resourcefulness** in enabling their ability to access and use knowledge systems

Unlike Fox & Varadarajan (2011) and Turcsanyi-Szabo's (2011) use of Twitter as an assessable item in their courses, this course did not mandate the use of Twitter. I encouraged and advocated for its use in lectures, discussed its relevance as a revision tool and an active thinking tool. I did not provide any training on how to tweet. I did set up the twitter hashtag and reminded students to tweet during the lectures. At no point were the students marked as part of assessment for the course. All tweets posted during the 13 week course were collated and analysed for evidence of three types of interaction- Learner-learner-instructor; Learner-content and Learner-interface.

Results and Discussion

Learner-leaner-instructor interaction: Tweets that fall into this type of interaction include- student's individual tweets, re-tweets, students' tweeting to student followers and students' tweeting to the lecturer, as well as the lecturer tweeting individuals and the student group. At the onset of the course I was the main instigator of the tweets, which were mainly focused on encouragement to have a go (Figure 1).

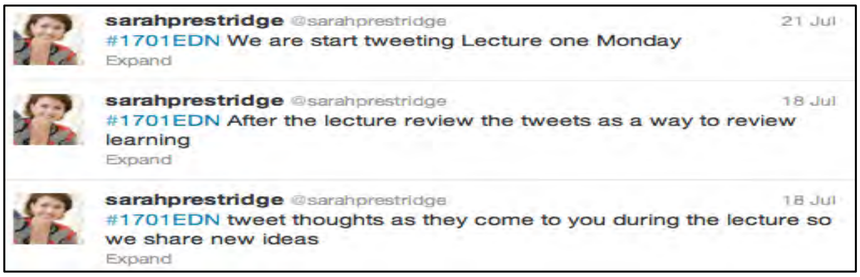

Figure 2: Encouraging Tweets by Lecturer

Following this I tried to stimulate tweets by tweeting a question to the student body based on what we covered in the lecture, see Figure 2 as an example. Student rarely answered these stimulus questions. Rather, questions constructed by the students, see Figure 3, were more common. Initially I answered these, which would be considered the typical student-teacher dialogue. However, as Twitter is a social networking environment, I began to leave student questions unanswered to see if other students would respond, supporting learner-learner interaction. This did not occur even as we progressed through the course when students were becoming more familiar with the medium. There was also a lack of re-tweeting, where a student would re-tweet a fellow student's tweet to emphasis a good point. This indicated a lack of learner-learner interaction in this context.

Figure 3: Lecturer question

Figure 4: Student initiated question

There was also evidence of disengagement by students when I asked a direct question that puzzled them as evident in Figure 4. When a student posted a tweet that demonstrated some confusion with the course content and I responded in a manner to extend thinking, disengagement occurred. This could indicate that this environment does not enable the channels for deep thinking rather that content complexities may be better dealt with in a face to face setting, as evident in other online communication tools (Prestridge, 2010). However, thinking about this in a different way, Twitter illuminated what content students were having trouble with which could then inform future teaching. The learner-instructor interaction was minimal when content confusion occurred.

Figure 5: Student confusion

As the course progressed substantive interaction between the students and myself occurred as evidenced in this 12-tweet conversation that occurred over 5 days (see Figure 5). The topic was covered in the lecture. The student was stimulated by further reading and continued to post her understanding of the concept outside of contact time. The learner-instructor dyad is evident here. It was learner initiated followed by instructor questioning to enable the student to explore the concept in relation to the course content.

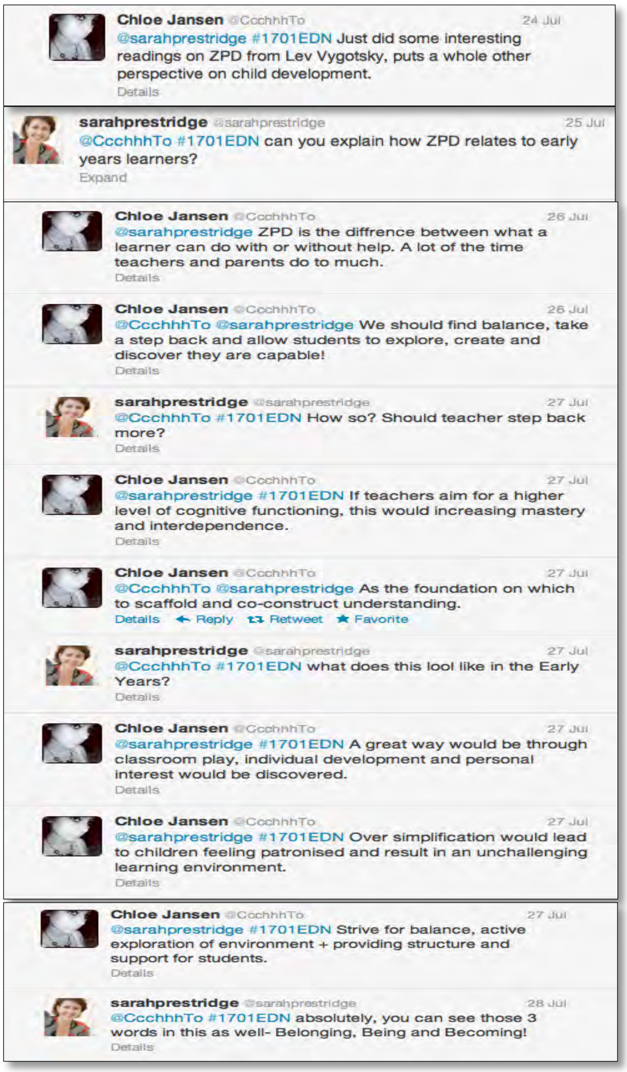

Figure 6: 12 tweet learner-instructor interaction

Learner-instructor interaction was the most evident form of interaction. The interaction was based on student direction and interest with support and direction provided by the instructor. Twitter was not found to support high levels of learner-learner interaction other than student tweets to the student body. Student tweets to nominated students to further explore course concepts or re-tweet posts were not evident. Instructor lead questions, instructor-learner interactions, were also not evident. This indicates that a student's sense of connectedness was found in the student-instructor interaction, meaning that it was initiate by the student, based on their needs and interests and supported and extended by the lecturer in this context.

Learner-content interaction: Enabling students to be active learners, to interact with course content to support their sense of academic culture is a defining characteristic of education. Paraphrasing was a common way the students tweeted course content as indicated in the two tweets in Figure 6. These tweets show that the students were building knowledge and understanding of the course content by paraphrasing key points during lectures. This commonly occurred throughout the lecture series.

Figure 7: Paraphrasing

It was suggested in a lecture that one way to explore the meaning of a set of Teacher Standards was to create a Wordle and identify the key words in the resultant image. During the lecture students actioned this idea and posted it on Twitter straight away (see Figure 7). This tweet was re-tweeted by other students indicating its value.

Figure 8: Re-tweeted Wordle

Other ways that the students interacted with content moved from paraphrasing what was said in the lecture to applying the content to a situation and tweeting it (see Figure 8). In this tweet the student states the key points and expresses direction and application of the content.

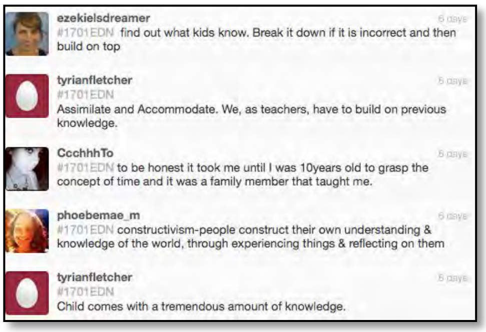

Figure 9: Redesigning the content

Students' paraphrasing, actioning and applying the content to their own understandings evidenced learner-content interaction. Paraphrasing lecture content was common whereas the application of content by students began to emerge as the course progressed. The movement from paraphrasing to applying the content indicates an engagement with a student's sense of academic culture.

Learner-interface interaction: This type of interaction focuses on the technology as the learner must have the ability to mediate the technology to engage with the course content and other students. The leaner must also understand specific communication protocols to be an active participant and must not disengage, be fearful and or be persistent enough not to give up. The literature reviewed indicated that the students in this course, characterised as Millennials, prefer learning with technologies, actively and by multitasking. Tweets indicate that students struggled with the functionality of Twitter (see Figure 9) and did not apply the correct academic protocols to the environment (see Figure 10).

Figure 10: Twitter functionality

Figure 11: Incorrect protocols

Students expressed to me after the lectures that they were having trouble 'getting on' and often gave up, became frustrated and missed important content given in the lecture. This was also evidenced in one student's tweet stating that she did not like to multitask by tweeting and taking notes (Figure 11). This indicates that students did not see tweets as a form of taking lecture notes. Students did not recognise that the tweets during the lectures provided an account of the main ideas plus peer discourse about the content. This represents an emergent phase of understanding of functionality of Twitter and a lack of understanding of Twitter as a learning tool. Also it indicates that Millennials do not always multitask effectively.

Figure 12: Frustrations with Twitter

Further frustrations were evident in student tweets when dialogue was misinterpreted (see Figure 12). The example provided was a series of tweets started by the student representing learner-instructor interaction (which was established as the dominant form of interaction previously). Ebonie Jane became 'lost' in the dialogue when my response questioned her post to try to extend her thinking. This might have been based on a lack of confirmation of her tweet. There is evidence here of a frustrated response to learner-interface interaction which could be based on the restrictions imposed by tweets- 140 character limit and by the lack of other sensory input that restricts the flow of conversation through digital communication tools. It could also indicate that reaffirming responses rather than questioning or challenging responses would be better served through this medium.

Figure 12: Display of student misinterpretation

Interestingly, as the course progressed, students were able to tweet their lack of understanding of course content on Twitter as in Figure 13. This indicates a greater confidence in the Twitter environment.

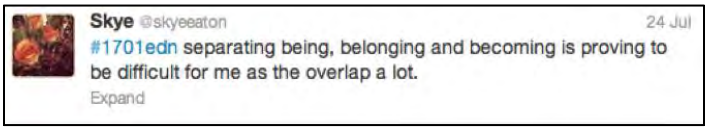

Figure 13: Display of lack of understanding of content

Learner-interface interaction is important to both conceptualise the type of discourse supported by the technology and the quality of the discourse. As evidenced here, students did not conceptualise tweets as valuable peer constructed lecture notes, they became frustrated with the interface, the discourse was misinterpreted and confused and academic protocols were not always applied. However, as the course progressed and the use of Twitter became more familiar, it was evident that more risk taking with critiquing of content occurred. This indicates that a student's sense of resourcefulness was not effectively developed to use Twitter to engage fully with course content and other students virtually.

Conclusion and Implications for future practice

This paper has explored the use of Twitter as a tool to engage students in an active learning, multi-tasking, and information producing approach to learning in a University course. Twitter was implemented as a tool to learn with, as a co-constructive approach that was encourage for its educational potential not through required assessment. This approach is considered richer for learning but harder to enable. Three types of interaction were analysed to identify if students' senses which frame the Universities' First Year experience program could be supported through Twitter. The three student senses that aligned to the types of interaction were learner-learner interaction with connectedness; learner-content interaction with academic culture and learner-interface interaction with resourcefulness. A student's sense of connectedness and academic culture were supported through the use of Twitter, however, their resourcefulness restricted and limit their engagement.

'Connecting' as a university student was illustrated predominately through leaner-instructor interaction where the student posted a tweet about something of interest and the instructor responded in a manner that supported the flow-on of discourse. In this way the learner chose the concept to discuss and the instructor was responding to their needs. It was evident that 'connecting' did not occur through a question tweeted by a student or by an instructor, and little student-student interaction occurred. Academic culture was exhibited in tweets through paraphrasing of lecture content. Paraphrasing was identified as the beginning phase of knowledge development and was considered a vital opportunity to support this process. As the course progressed, students demonstrated active learning processes by tweeting images, links, re-tweeting and eventually applying knowledge to their own contexts. Developing resourcefulness within the university electronic system was evident in student's interaction with the interface of Twitter itself. It was found that the majority of students struggled both with the functionality and conceptualisation of Twitter as a learning tool. Students had trouble getting on, applying academic protocols, were limited by the 140 characters and found it difficult to multitask, ie, tweeting and taking notes. Students did not conceptualise tweets as lecture notes and missed this opportunity to be collaborative active learners.

Realisations that emerged from the use of Twitter include an understanding that complex concepts that are presented in lectures can be simplistically dealt with in tweets in encouraging ways as part of the learning process but complexities need face to face exploration before they can be critiqued in this environment. This illustrates the development of understanding and knowledge construction that occurs through the life of a course and can be supported in students' tweets moving from paraphrasing to applying content. Importantly, for Twitter to be an active learning tool, lecturers need to ensure that students conceptualise it as a way to collaborate with their peers academically, as a learning process, and as a way to facilitate thoughtful engagement with course materials that will aide all students.

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nDiVE: The Story of How Logistics and Supply Chain Management Could be Taught

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Abstract: One major element of supply chain management education is helping learners to grasp the complexity, the challenges, and the efficient management of the multiple dimensions in supply chains. Each decision made can 'ripple' through supply chains and have serious repercussions that may include causing millions of dollars in damage or triggering a chain of events that degrade the quality of life for people, society, or the environment. We can teach relevant theory and train learners for some situations that do not require immediate responses. However, we remain disadvantaged by the constraints of time and space; observation of a real supply chain is often unpractical, and lengthy times for transports exceeding any class duration. In this paper, we present the nDiVE project which creates a supply chain story to immerse learners, provide an authentic experience in a realistic environment, and apply traditional and advanced gamification mechanisms to engage and motivate learners.

Keywords: Action-based Learning Assessment, virtual training environments, feedback, authentic learning

The Beginning

Supply chains can be relatively small, such as a small local manufacturer that supplies nearby markets, or they may be much more expansive and globe-spanning, consisting of long-haul transport between multiple stages of manufacture and assembly. Teaching learners about supply chain management involves evolving learner awareness regarding the complexity and multiple dimensions in supply chains. The multifaceted nature of real-world supply chains incorporates their geographically distributed facilities, long and variable lead-times between stages of production, manifold production systems and mentalities, availability of resources, constantly changing markets, unpredictable financial interdependencies, and the possibility for many unexpected events to cause disruptions or erroneous outcomes that could potentially cause millions of dollars in damage or trigger a chain of events that degrade the quality of life for the people, society, or the environment (Reiners et al., 2012). Since the turn of the millennium, scholars have worked hard to transfer this complexity into textbooks and classrooms to support education about supply chains that encompass an understanding of space, time, cost/budget, process, relationships, environmental or other risk factors, sustainability measures, or technology (inter alia; this is a small sample of relevant subjects, demonstrating the breadth of issues that must be addressed). Textbooks embed learning materials using real-world case studies, theories are applied to real-world data, and results from optimisation algorithms for the problems in the warehouse location are visualised in map-overlays; yet, despite these advances we still fail to achieve an authentic and immersive experience for the learner.

'Study tours' are often touted as an authenticity-increasing alternative to classroom-bound education as they help learners to understand context and practical significance. Study tours have become an increasingly viable support of authentic education and are an important method in contemporary tertiary education (Reiners et al., 2012). However, while "the study tour helps to bridge the gap between business theory and practice" (Porth, 1997, p. 198), we must acknowledge the significant drawback of study tours: they offer a limited peek into several 'slices' or 'chapters' (the term we adopt) of the supply chain and the perspective is usually that of an external visitor, limited to predefined walk-ways in safe areas and without access to deeper knowledge or data about the location. Obviously, site tours cannot be included in all programmes due to the high costs (i.e., financial resources and time requirements), limited access to suitable and connected companies in their region, the distribution of distance education learners, and the maintenance of appropriate learning objectives in well-designed and coordinated visits (Hanna, 2000), as well as risk factors involved in visiting some sites without appropriate training and/or clearance. Depending on the geographical location of the class, it may be possible to tour several connected stages of a supply chain; yet other areas may be forced to sample related chapters from different supply chains that are not connected together, losing the customer-supplier relationships (Hanna, 2000).

In this paper, we tell a story that describes the research project 'nDiVE' (see acknowledgment) about the immersion of the learner in an authentic n-dimensional environment. The following section, logistics as a journey, describes how we condense the multiple dimensions (the exact number depends on specific learning outcomes for the programme) into a restricted, authentic, immersive story (using a virtual environment for visualisation) to demonstrate, simulate, and control real-world situations in a format that allows students to grasp the highly complex and interwoven processes. We decided to encode the learning material as an interactive story similar to the Grand Theft Auto (GTA) video games or the old Dungeons & Dragons games (Loh, 2007) as this supports the establishment of suitable scope and narratives while leaving the learner free to explore the space and create their own perspective on the established learning outcomes. In the next section, realism and authenticity, we outline the importance of deciding on the appropriate balance of realism and authenticity in presenting learning materials. We use different technologies depending on the learning objectives as well as the perspective the learner inhabits. Gamification is the use of game thinking and mechanics in a non-game context in order to engage users and solve problems (Werbach & Hunter, 2012; Wood & Reiners, in press). Gamification addresses the problem that the perfectly designed learning environment is not sufficient for a complete learning experience; learners have to be engaged and motivated as well. We integrate gamification mechanics to trigger each learner's "fun, play, and passion" (Deloitte, 2012). We conclude the paper with an outlook on the future plans of nDiVE and opportunities to transfer the demonstrated concepts to other areas.

Logistics as a Journey

While the sheer magnitude and complexity of a full, intertwined and networked supply chain makes a comprehensive simulation impossible and undesirable to implement, we aim to maintain some of the scope and complexity. For nDiVE, we use an exemplary supply chain to 1) follow one product starting from mining raw materials, processing and manufacture, through to providing goods to customers; 2) demonstrate the need and application of knowledge, experience, and skills; 3) taking a different perspective or role within the same scenario; and 4) relaying it to the real-world. The supply chain is presented as a map showing the key chapters of the supply chain story: sourcing raw material, processing, transport, manufacturing, distribution, and the customer. Within the overview provided by the map, each chapter is a 'black box' (i.e., the internal function is not important). The map in Figure 1 shows the sequence of chapters to be opened for further investigation.

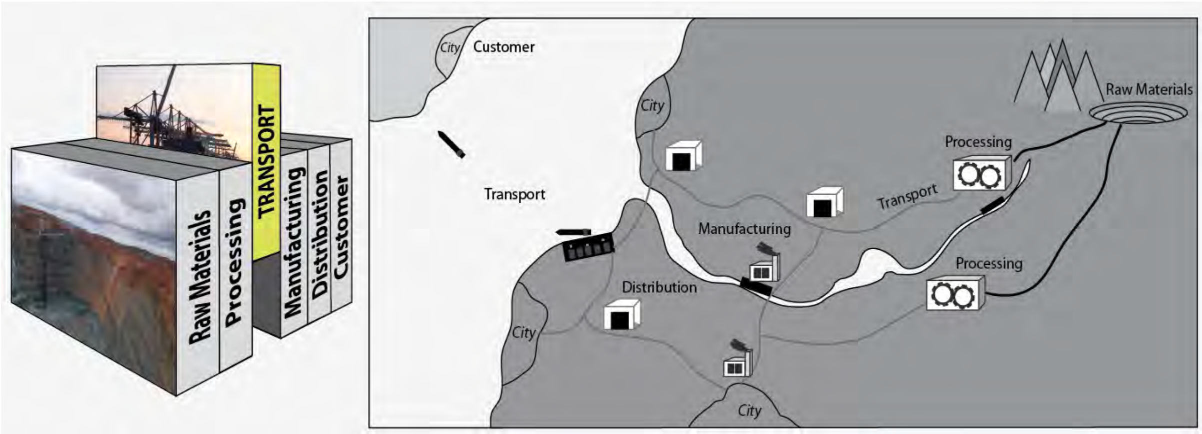

Figure 13: The map – corresponding chapters for each step in the supply chain

This representation encapsulates a logical ordering similar to the chapters in a textbook, mimicking the real-world flow of materials from supply to consumer. Similar to the textbook, the supply chain is only complete if all steps (chapters) are included, yet each step addresses a distinct subset of the whole that can be selected as a topic for a learning unit (Reiners et al., 2012). Before continuing with the storytelling of nDiVE, we first outline how we address different kinds of 'immersion' in this project to create a more compelling learning experience.

Immersion and authentic learning

Immersion is the feeling that one is participating in a realistic experience (Dede, 2009). The more one is immersed, the more one ignores other things for significant times. People can be captivated in movies, books, or games and not realise that they have not moved for some time or maybe even eaten (Reiners, Wood, & Gregory, under review). Authentic learning occurs when an environment replicates practices and actions found in real-world environments. Students receive feedback following immersion in authentic materials or activities. The learner can make mistakes in context without real life consequences through authentic tasks using gamification (Herrington, Reeves, & Oliver, 2010); that is, adding game-based elements into a non-game based activity. Truly authentic learning can be costly, dangerous, or administratively difficult to arrange. Simply using technology does not create an authentic learning scenario but authentic learning can take place supported by technology (Teräs & Myllylä, 2011). 3D representations of the real world can heighten immersion for learners in activities whilst increasing the learning experience authenticity.

We use the simplified map (Figure 1) to guide learners and to connect learning materials to sections, fixing and defining context. Together, this transforms classrooms from a place for slides to a space for conveyance of "information in a compelling and memorable way" (Neal, 2001, abstract, para. 1) in the "original form of teaching": storytelling (Pederson, 1995, para. 1). Storytelling is the art of using words and gestures to manifest a story in learners' minds, creating connections that result in creativity, combining shared impressions with our personal experiences, understanding, and knowledge to generate our own, individual story. Similar to observations of the film industry and script writer roles, instructional designers make use of both given contexts and technologies to support their design and sculpturing of an environment: the story. Subsequent narratives, or unique paths, through the story also enliven the story and allow it to "unfold in space" (Nitsche & Thomas, 2003, p. 85).

Stories rely on narratives; within educational settings narratives may be created by either the teacher or by learners. Teachers provide domain-expertise and knowledge-based design of model answers in addition to suggestions about traversing the story. Milestones can be defined by teachers, representing sequences of actions in the scenario, with continuity between scenario segments). Learners are guided by teachers' narrative but interact with the teacher-driven narrative to form their own perception and awareness. Narratives support the process of understanding and building cognitive structures (Bruner, 1990; Riedl & Young, 2003); they are dynamic whereby every disturbance within the classroom-bound pond of passivity results in a change of narrative and, simultaneously, the path to the achievement of the learning objectives.

The teacher occupies the role of the storyteller and is responsible for the story and for maintaining the paradoxical tension between flexibility/openness and defined outcomes/requirements; a role similar to the 'Dungeon Master' in 'Dungeons & Dragons'(Log, 2007), the teacher becomes a 'Lecture Master'. The storyteller allows learners freedom to explore the learning space incorporated activities scoped to keeps learners on track. Within an industrial context, a manager can monitor employees' activities towards objectives providing the opportunity to gently (or brusquely) provide the employee with guidance to ensure that activities are finished on time. Such maintenance of schedules and progress ensures that employees' efforts are not wasted. In nDiVE, we use a plot-based- (i.e., the teacher-created narrative) and character-based-storytelling (i.e., the narrative created by interactions between the learner and environment) (Danilicheva, Klimenko, Baturin, & Serebrov, 2009). The plot-based storytelling is used at the top-level, where we outline the story and define the focus of the supply chain and constituent chapters to meet topic coverage requirements and learning material. The chapters are intended to be character-based; where the achievement of learning objectives is more important than a static path. This aligns with Nitsche and Thomas' (2003) *Story Map*: the learner explores the virtual environment and maps the space and story. The story is tied to the navigation of the space (Murray, 1997) rather than being purely teacher-defined and -implemented.

In nDiVE, the design of the story includes the following core tasks:

1. *Defining the goal with respect to the context and stakeholders:* What is the knowledge and skills we want to teach while the story is completed? How do we tell the story? While an academic post-graduate course must include theories, the same topic taught to workers that must understand the real-world challenges during their workplace induction would require a more routine, training-orientated focus.
2. *Outlining the main milestones:* Here, the milestones do not necessarily reflect the completion of chapters or the narrative, but the main topics to be covered with respect to the learning objectives. Chapters and narratives remain independent as it is often impossible or impractical to aggregate everything in one chapter; elements may be embedded in several chapters where they demonstrate strong fit.
3. *Setting the main scope of the chapters:* The learning objectives for each chapter must be ascertained and material to be excluded explicated. Following our analogy, each is similar to chapters within a supply chain textbook, each emphasising a different topic within nDiVE. The learning objectives dictate the design of the map and inclusion of particular landmarks. At this point there are no details about the learning material or how to encode and present these details to learners.
4. *Deciding on the methodology and technology to use for the chapters:* Using technology has two facets: 1) it can create the right environment for the learner with respect to immersion, authenticity, or availability, but 2) it might distract from the content and intimidate learners who possess poor technological knowledge or lack access to appropriate equipment. For nDiVE, we require the technology for content as it simulates specific real-world scenarios and must be immersive and authentic; e.g., learning about safety and health or specific processes. Alternatives are available, but will reduce effectiveness of experience. In general, technology is used as needed, but not just to 'show-off' or provide a 'wow-factor'. Requirements are minimised to support distant education and classroom lectures as users may not have access to specialised technology.

A key question is whether the story requires a restrictive framework, which constrains the learners' freedom. The learning objectives should be selected according to the wider context (e.g., a university course, training for a job, or a certificate relating to a specific task). The general framework must fulfil the requirements and be accepted and accredited. Figure 2 illustrates a possible story, including a brief example of a teacher's narrative. The visualisation of the individual chapters of the story demonstrates another element related to immersion (which we return to next): realism and authenticity. These should be part of the story design. Thus, chapters should allow for alternative pathways, particularly in respect to technological limitations and the subject of study; shown in Figure 2 by branching the story into alternative narratives. Not shown in the figure are the learner narratives (see description for Chapter 5; distribution), representing a subset of the teacher narrative (according to pre-existing knowledge) in an individual order. The freedom is constrained as a (reduced) number of learning objects has to be fulfilled to pass the course. Note that each chapter has a unique narrative representing a challenge or a side-story.

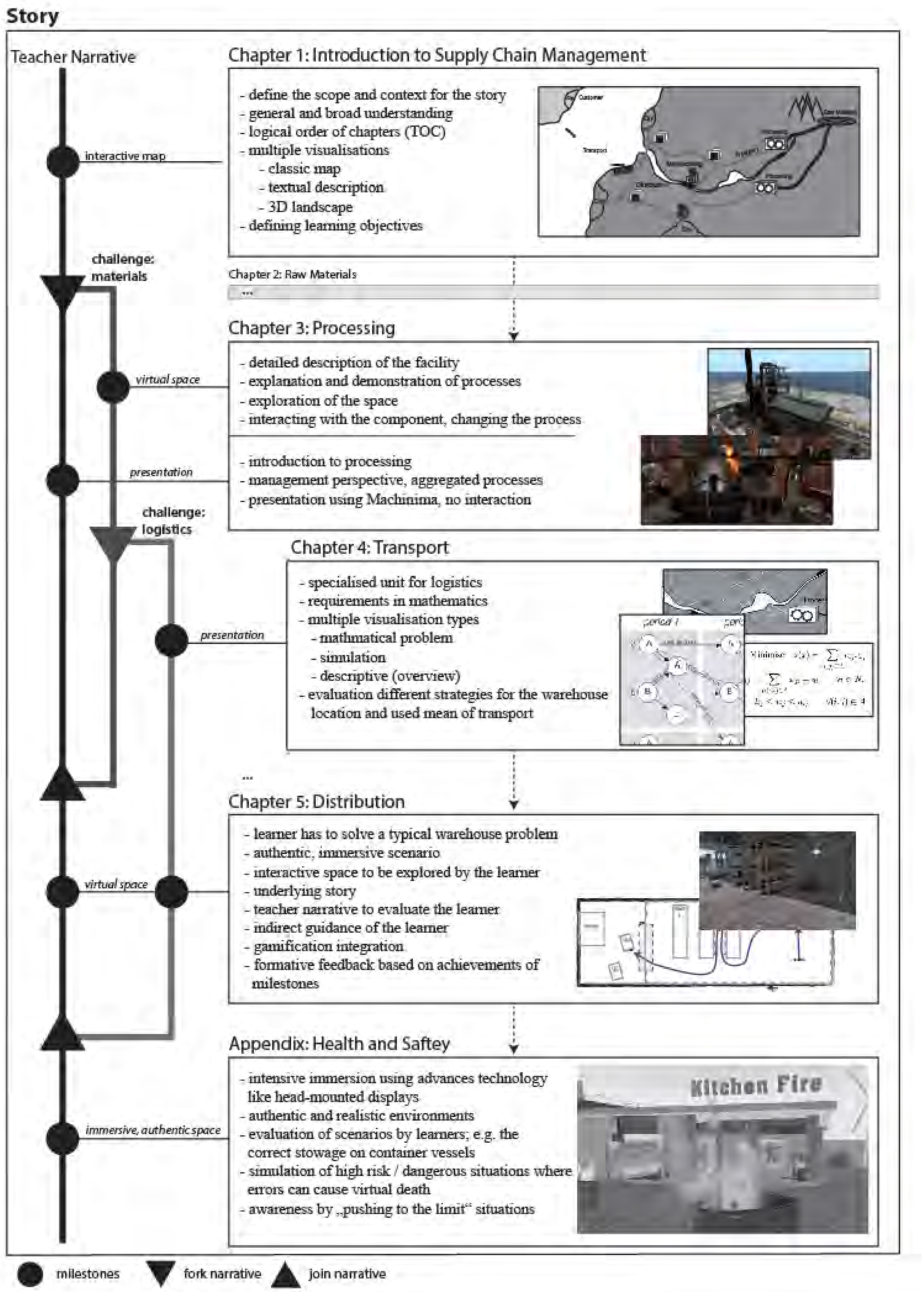

Figure 14: A possible story

The chapters in Figure 2 depict a subset of examples from our supply chain story, illustrating the outline and variability of learning material presentation (extracted from the map in Figure 1). This is a possible selection of chapters from one story and there may be more topics than visualised as locations on the map (e.g., ‘health and safety’ is a topic applicable to most map locations and could therefore be inserted multiple times on the narrative path).

Chapter 1: The introduction describes the scenario and the terminology. We use the analogy to the real world; i.e., to lower the scepticism that many learners have towards this area.

Chapter 2 (not shown in Figure 2): Introduction to mining; i.e. layout, equipment, and processes. The unit includes a mine site induction that creates awareness of risks of injuries and/or death. This chapter requires a high degree of authenticity and immersion to gain experience beyond currently common inductions consisting of written examples and multiple choice questions; see Chapter 5 for a short example as well as Reiners, Wood, and Dron (in press).

Chapter 3: Introduction to raw materials processing; illustrated here by a Second Life-based steel production facility. The site allows for exploration without risk or restrictions. The learner can investigate details and learn about processes by following them (e.g., walking with the train carrying molten iron-ore). Where details are not required other means of presentation can be used; e.g., Machinima (i.e., in-world videos).

Chapter 4: This chapter exemplifies a non-technology-based presentation that can be interwoven with nDiVE to address specialised students in Logistics or Operations Research. While Chapter 1 introduced the supply chain and warehouse locations, it is important for students to understand warehouse location decisions and how goods should be distributed throughout processing and manufacturing; i.e., how many items are stored in which warehouse and how the transport is organised. Here, developing mathematical models and solution algorithms is relevant; which can be taught by lecture, tutorials, exercises, and textbooks.

Chapter 5: Gamified explorative learning about order fulfilment in a warehouse. The learner is positioned in an authentic, immersive environment. Besides clues from the general context, the learner receives only rudimentary instructions and instead acquires guidance from indirect signals, communication with bots (non-player characters), or placed messages; e.g. a customer call is received when the learner walks out of the warehouse without the order or the boss talks to the learner via the speaker if incorrect or unhelpful activities are undertaken. This triggered (formative) feedback is achieved by monitoring the learner continuously for activating triggers associated with corresponding reactions. For example, if the learner uses the wrong forklift (e.g., one with insufficient capacity) it will tilt over and the learner must restart or use gamified mechanisms such as rewinding to a previous state (the moment where the learner picked the forklift) or restarting the whole scenario (Reiners et al., 2012). The final evaluation assigns scores for the time required, number of orders being fulfilled, amount of damage caused, or hints received by the environment. The learner can repeat the chapter to improve the score for a better position on a leaderboard.

Appendix: Scenarios with high authenticity and realism at the end of the unit to demonstrate the application of the knowledge and skills, smooth the transition from the (virtual) learning environment to the real world and teach about real-world risks.

The main narrative path connects the chapters in a logical order (i.e., the progression of chapters as we might see in a textbook), while each chapter has its own narrative path (e.g., shown in the ‘distribution scenario’ in Chapter 5 of Figure 2). The narrative path provides guidance and establishes comprehension of relevant elements that may be required to fulfil learning objectives. This is a simple but effective mechanism to address the manifold backgrounds and interests in a class (similar to adaptive/intelligent learning environments). The main teacher path on the left in Figure 2 bypasses the transport chapter; which is intended for specialist education for logisticians about optimisation algorithms. We use milestones on the path to indicate requirements for learning content and learning methods. For learners without special focus on processing and materials it might be sufficient to illustrate elements of the topic using Machinima and case studies; while others may wish to explore the processing facility independently in greater depth (see explanation of Chapter 3 in the dot-point list above). To acknowledge the different learning needs, we allow splitting/forking and joining of narratives. Note that the logical order of the chapter can largely be considered as a suggestion or a requirement, while all milestones must be met. Clearly there are time/action dependencies for milestones; e.g., in the example of Chapter 5, the forklift must be started before it can be driven.

A key objective of nDiVE is to create awareness of, and appreciation for, the complexity of supply chains, particularly manifested by the dependencies between causes and effects, often separated by time and space. Learning periods of ten or twelve weeks make it is impossible to observe real-world scenarios; i.e., those with manufacturing lead times of two weeks and six-weeks in transit between continents. Figure 3 demonstrates chapter connections where a learning outcome from one chapter is reflected in the following chapters. That is, the created output of the ‘processing chapter’ is input for the ’transport chapter’, which is linked to the ’manufacturing chapter’. An example is: 1) the learner mistakenly allows a component to cool down too quickly; the resulting micro-fractures are not visible but can be detected with specialised equipment. This component is packaged and then later used in a machine elsewhere, which malfunctions and halts production, causes damage to equipment or workers, and significant financial loss. These interdependencies are implemented within the narrative, allowing the learner to track the part back to the production, and reflect on the processes and connections that may not otherwise have been apparent. The learner can track the component back to the moment of error; meanwhile, learning how to prevent this mistake and becoming sensitised to cause and impact, even where problems are separated in time and space from the cause. In some respect, the learner follows the path until some event or incident; whereupon the story turns into an investigation where the learner has to take the role of the detective tracing back the evidence to the cause.

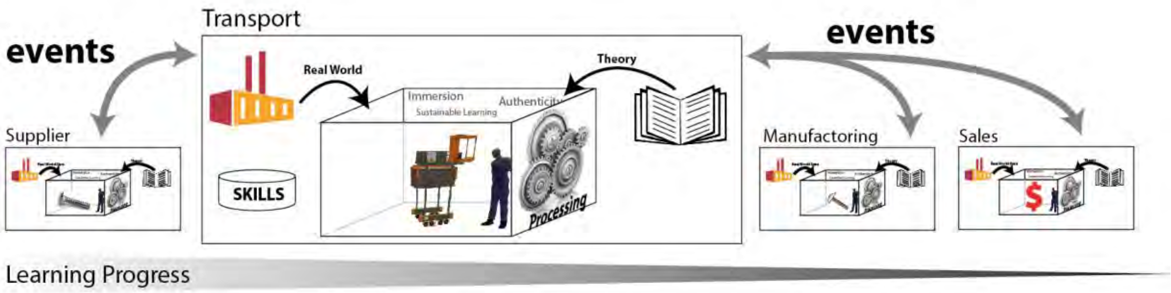

Figure 15: Chapter connections

This approach means that the classroom itself becomes a reflective and team-based learning space, while the story in the virtual environment "provides relevance and meaning to the experience. It provides context" (Kapp, 2012, p. 41).

The realism and authenticity

nDiVE aims to enable and support authentic learning, requiring learning to occur within environments that replicate actions and requirements as they may be presented or experienced in a real working environment. Reading corporate negotiation dialogue in a textbook may be inauthentic; negotiating with a classmate about who should lead the assignment project is more authentic; negotiating with a businessperson in a meeting room about the project requirements in a work-integrated-learning paper is more highly authentic. Authentic learning enables experiences and learning to be more completely contextualised. However, it can be costly and difficult to implement, as well as administratively difficult to arrange (Reiners & Wood, 2013).

While 'authenticity' is often assumed to imply 'realistic', this is not necessarily the case; it is most important that the learning and activities reflect the development and use of the knowledge as required in the given real or virtual environments (Herrington et al., 2010). Thus, a process can be highly authentic, but in a non-realistic setting, creating disconnect between what is being accomplished and the setting it is accomplished within. This can be overcome by increasing immersion in the task.

Fidelity is a measure of resemblance to real environments; thus, high fidelity environments have a high degree of resemblance to real environments, where a very realistic simulation has been employed. While it may be expected that fidelity is required for learning, it has been demonstrated that learning environments need not be high-fidelity to encourage positive learning results. Practically, this means that a low-fidelity environment may be adequate to gain the benefits with minimal resourcing. Similarly, high-fidelity may not be required for high levels of immersion (Bastiaens, Wood, & Reiners, under review). The 'sweet spot' must be identified where adequate resources allow creation of suitably immersive materials that can be relatively easily constructed and developed to gain the outcome with minimal effort; see Figure 4.

Research indicates that head-mounted displays (HMD) like the Oculus Rift headset (Wikipedia, 2013b) can significantly increase the immersion of the user within the virtual scenario. Here, the realism of the display is significantly lower than what most users will experience with their 3D virtual environment on a monitor; the Oculus Rift development kit uses a 640x800 pixels display per eye, compared to HD monitors using 1920x1080 pixels. However, participants in a research experiment reported that scenarios with the Oculus Rift felt 'very real, almost perfect' in comparison to other 3D environments like Second Life (Reiners, Wood, & Gregory, under review). The perceived realism caused the majority of participants to investigate potentially hazardous scenarios (e.g., walking on an oil rig) with greater caution when using the Oculus Rift, despite their awareness that this was a game-like environment. In almost all cases, participants experienced strong physical responses to purely visual stimuli (Reiners et al., under review). Most participants tried to grab a supporting structure that existed only virtually and most participants moved their bodies in response to events in the virtual environment. All users rated the use of Oculus Rift in Unity-game-based environments as being more realistic, usable, interesting, engaging and compelling than Second Life on a normal monitor.

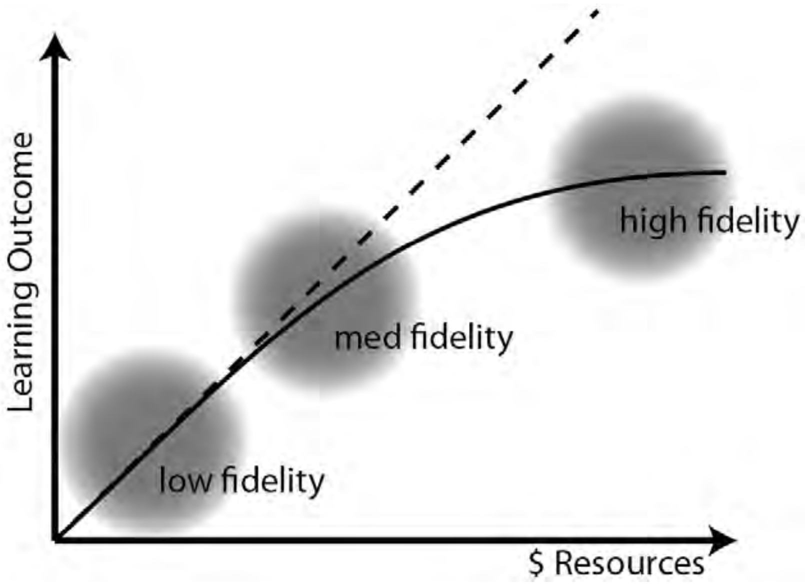

Figure 16: Relation between resources and learning outcome regarding fidelity

The fun, play, and passion

Storytelling is about creating illusions and building up suspense to finally reach full immersion in the narrative. The learner needs to connect and stay connected with the story. The narrative must be adapted to the characteristics of the learner and must trigger further attributes like fun, play, and passion to drive user motivation and engagement. Recently, the idea of using game design elements in non-game contexts (Deterding, Dixon, Khaled, & Nacke, 2011) became prominent under the term gamification; i.e., to incentivise and alter user behaviours. Games are acknowledged for being able to cast a spell on the player (Jennett et al., 2008), immersing them to such a level that they disconnect with the real world and forget about immediate needs (e.g., thirst) and time. Our task as instructional designers and lecturers is to learn about the motivational properties of games and embed their mechanics in the learning material (Landers & Callan, 2011). The intention is not to create a game but insert an extra layer of game-based elements to provoke desired behaviours.

Gamification appeals to learners because people like to find solutions to challenges and puzzles, they enjoy the adrenaline rush of winning and want to elevate levels (Hokkanen et al., 2011). As we drive to work we can subconsciously gamify the experience to pass the time: we can imagine what other travellers are doing and their ‘stories’, we play games such as counting the number of different coloured cars, or play guessing games as to where different commuters are travelling. Systematised gamification can include multiple recordings, rewinding and elevation of levels through badge systems.

Our use of gamification is not linear or fixed. We provide an open space for learning; even though having boundaries to maintain the user within the scope of the learning objectives. Users can deviate in the open space. It is all about achieving the outcome; not necessarily how this is achieved. (Note that verification of the state of objects or the environment is necessary to prevent certain critical states or actions. Moving a box from the twentieth floor can be accomplished by dropping it from a window; yet, using a pulley and rope would cause less damage and lower the risk of hurting innocent people. Still, it is the learners’ choice to pick from valid methods like pulley, lift, carrying, cranes, or helicopters as long as the aim of the scenario is fulfilled). On completion, the result is assessed by criteria such as time taken, cost, or damage; thus, while a helicopter ride may be fun, it is not the most cost-efficient solution in a commuting problem and therefore maybe not preferable over others. Recorded variables like completion time are used to calculate a score; which the learner can improve on further runs. If a learner ‘gets themselves killed’ or a makes a ‘fatal mistake’, points are deducted but it does not have an impact on the actual person. Virtual learning environments enhanced with gamification enables learners to repeat situations over and over to discover the correct solution to improve their score (McGonigal, 2011). When playing games, there is a very high percentage of failure rates, approximately 80% (Fujimoto, 2012), where the player is engaged to master the game and complete the task – a failure rate we do not often see in the classroom.

Learners receive points, badges or leader-board merits through gamification techniques, promoting a competitive atmosphere where users attempt to outdo others, while immersed in the learning scenario. Familiarisation with the learning environment can motivate learners to challenge more experienced learners (i.e., progressing up the leaderboard). In theory, it can promote a competitive atmosphere, full of rivalry, as users compete to outdo one another. In practice, such an approach can produce stunningly negative dynamics, as unintended consequences spring forth from the thoughtless application. Consider what it would feel like if you were to join an internet-based social media where there are some well-recognised users with astronomical points and a collection of badges that would make a boy scout green with envy. While this might inspire you, it will undoubtedly turn-off other users. Instructional designers must balance gamification components; for example, introducing handicaps in golf or by comparing learners only at the same level. A comprehensive overview extending beyond gamification elements of points, badges, and leader-boards is provided by Reiners et al. (2012); Wood and Reiners (2012) provide a model for including elements in a logistics and supply chain management class.

The past and future

All lecturers are eager to teach comprehensively about their discipline; however, time and other constraints restrict them to focus on subjects and abstract from the complexity and magnitude of real-world scenarios. This can result in disconnected islands of specific knowledge, lacking perspective from the entire object of study; e.g., the supply chain as the example within the nDiVE project. This paper described a system that uses the concept of a story with embedded narratives to link the subjects and to demonstrate how an effect at the beginning ripples through the story. nDiVE incorporates well-established and emerging technologies to tell each chapter of the story in the most captivating and engaging manner by using a well-balanced mix of authenticity, realism, immersion, and interactivity. We further include gamification concepts by mapping outcomes of the learning process to present the learner with feedback about the quality of their learning.

nDiVE is an ongoing project with first prototypes for evaluation purposes being implemented. We selected the Unity 3D development tool as it provides a realistic physics engine that allows accurate simulation of behaviours in real-world scenarios (e.g., falling shipping containers). Another advantage is how the underlying game engine supports fast prototyping and the later cross-platform publishing and, therewith, increasing the flexibility for the learner to choose the preferred technology and to support distant education. Our studies showed that specialised hardware like the HMD Oculus Rift can and should be used to improve the effect of immersion (Reiners et al., under review); a topic of further investigation within nDiVE. Another relevant aspect in the future is about solving the struggle over the focus of the learning material and the learning objectives.

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Beyond Open Access: Open Publishing and the Future of Digital Scholarship

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This concise paper reviews the research and practice of open innovations in scholarly publishing, facilitated by the dynamics of open access, Web 2.0, and social media. Compared with traditional publisher-mediated system, open publishing not only provides a vast amount of openly accessible content, but also introduces a new communication system characterized by "publish then social filter". This paper aims to theorize the defining features of open publishing innovations and their impact on future digital scholarship. It also critically discusses the challenges for the uptake of open publishing in scholarly communication. It concludes by linking open publishing with a wider open knowledge communication system including open education and open science, from which future research suggestions are derived.

Keywords: open access, digital scholarship, academic publishing, Web 2.0, social media

The Rise of Open Publishing

With the rise of open access, Web 2.0, and social media, the scholarly publishing landscape has changed dramatically (Jankowski, 2013; Stewart, Procter et al., 2013). A growing number of digital publishing initiatives are approaching scholarly communication in new ways and incorporating dynamics of openness, networking, and collaboration into their most basic functions, for example, online preprints like Nature Proceedings and arXiv, social reference management sites like Mendeley and Zotero, scholarly blog sites such as Chemical Blogspace and ChemBark, scholarly wikis like Wikibooks and OpenWetWare, open textbook initiatives like Open Text Book Registry and Boundless, the reorganization of peer review in Science Paper Online, and the adoption of alternative metrics in PLoS.

The term "open publishing" has been used to define the emerging publishing system (Danezis and Laurie, 2010; Kahn, 2013; Scanlon, 2013). In this paper, the word “open” primarily refers to the openness of access that is inherent in these approaches, which provides unrestricted online access to scholarly content, not only refereed scholarship, but also a vast amount of informal publications. More importantly, the word “open” also highlights the fact that an open communication system, which connects authors, readers, and reviewers and enables collaboration among them, is fundamental to the emergent publishing initiatives (Nikam and Babu H., 2009; Brown, 2008) . As Scanlon (2013) points out, scholarly publishing “may be subject to change in two ways, due to the impact of open access publishing and the prominence of Web 2.0 technologies and social media”. Both are of fundamental difference from the traditional publishing system.

This short paper critically reviews the theoretical research on open publishing and the practice of open initiatives in scholarly publishing, which is based on a three years' PhD research project. The major research methods included multiple case studies of open publishing platforms, in-depth interviews with stakeholders, and participant observation on users' participation in the initiatives. This paper briefly discusses some findings and links them with existing literature to theorize open publishing innovations. It particularly focuses on how open publishing widens open access scholarship and reorganizes quality control mechanisms, harnessing Web 2.0 affordances and social collaboration. The impact of open publishing on future digital scholarship as well as the major challenges is also discussed. This paper concludes by understanding open publishing in wider open education contexts and suggesting future research directions accordingly.

Widening Open Access

The open access movement was primarily stimulated by the coincidence of the publishing capabilities of the web with the ongoing crises in journal affordability (Panitch and Michalak, 2005), together with a greater interest by both funders and researchers in the greater visibility and impact of more accessible research outputs (Finch, 2012; Miller, 2009; Willinsky, 2006; Harnad et al., 2004).

Open access aims to make peer reviewed literature freely available to all "curious minds"[17] while open publishing focuses on both refereed publications and informally published or pre-referencing content including working papers, drafts, lab data, scholarly blogs, teaching materials, reading notes, and so forth. As such, open publishing greatly expands the scope of knowledge that is publicly accessible and makes a significant portion of previously private knowledge exchanges visible to a wider academic public (Garvey & Griffith, 1967). Open publishing also widens the access into the whole life-circle of research from original ideas, lab data, through early draft, to the latest development, and even negative results; while traditional publishing only publishes final positive research outputs.

More importantly, open publishing encourages collaboration between authors and readers and their co-development and co-creation in research and publications. As such, the publications are not solid or frozen as in the traditional publishing system; instead, they are "liquid" and updatable (Casati, Giunchiglia et al., 2007). This is transforming publication into a dialogue in scholarly and learning communities "without mediation or obstacles" (Quirós & Gherab, 2009:63), in which all members involved are inspired by discussion, debate, and even criticism.

Borgman (2007) describes the meaning of open access as follows:

> Open science and the open flow of information are essential to the exchange of ideas. Sharing knowledge is the social glue that holds academic communities together, and publication is the coin of the realm.

From this perspective, open publishing is an intrinsic expansion of open access scholarly publishing. Open publishing enlarges the overall scale of knowledge being shared, widens the access to the whole life circle of research, and makes scholarly publications open for collaboration. The emerging system suggests a transition of academic publishing from a system with priorities of authority, quality, and longevity of publications to one that values instant exchange of knowledge, interactive communication, and continuous updates and remix of content.

Publish then Social Filter

Open publishing normally employs "publish the social filter" models, which are sharply different from traditional approaches to scholarly publishing. Traditional models are "characterized by a process of selection, editing, printing and distribution of an author's content by an intermediary" (Brown, Griffiths et al. 2007:3). In such a "traditional" system, either print or digital, publishers play a dominant role as intermediaries in the publishing landscape and quality control is regarded as the most important value added by them (Thompson, 2005). However, this system is not free of controversies. Time lags between submission and dissemination slows down the overall efficiency of knowledge exchange (Nikam & Babu H., 2009). Publishers' gatekeeping, particularly minority-based pre-publication peer review is criticized for subjectivity and bias (Angell, 1993; King et al., 1997), discouraging innovation (Whitworth & Friedman, 2009), and inappropriate filtering (Hendler, 2009).

The "publish then social filter" models, on the contrary, allow researchers, teachers, students, or the general public, to freely publish and share scholarly content without traditional gatekeeping while harnessing readers'

[17] http://www.budapestopenaccessinitiative.org/read

social collaboration and crowdsourcing to filter content and control quality. According to Correa, Hinsley et al. (2010), “being open to new experiences emerged as an important personality predictor of social media use”. In academic publishing world, a growing number of academics are open to the new experience of knowledge sharing and social collaboration.

Open publishing thus enables instant exchange of the latest research outputs and speeds up the overall communication of scholarly knowledge, particularly original research outputs. More importantly, a large amount of content that would have been considered unpublishable by traditional publishers is not only being made available, but the information that they contain is being used and built upon. The "publish then filter" models thus greatly expand the scale and scope of open access scholarly content as mentioned above. According to Cope (2009:17), “… the medium is not the whole message but … the textual and social processes of representation nevertheless give modern knowledge its peculiar shape and form”. The dynamics and freedom of "publish then social filter" models are not only changing the publishing communication system, but also the content being published, and the overall system of publishing.

Ease of publishing does not mean that open initiatives necessarily neglect quality control or fail to value quality. Rather, working with a “publish then filter” model allows these initiatives to identify and reward quality in innovative new ways. Open publishing Initiatives like arXive or PeerJ Preprint, employ a variety of light-touch gatekeeping before publication, e.g. preliminary editorial filtering, real name verification, or light peer review with only less than 30% rejection rate.[18] Light-touch gate keeping improves the quality of publish-then-filter academic publishing by blocking unacceptably low quality content. However, the “social peer review” process that is a hallmark of these sites is carried out after content has been published and all readers and their social networks play an essential role in it. There are a variety of social filtering models. Social reference management is an increasingly important mechanism to socially distribute and filter scholarly content, harnessing readers' collaboration and crowdsourcing. Mendeley, Zotero, Connotea, and CiteULike are internationally well known platforms for social reference management. These platforms enable participative users to share, recommend, comment on, and remix scholarly publications in collaborative yet customised ways.

Based on a specialised social network of research peers with common interests and expertise, social reference management allows individual users to share personal libraries and exchange reviews, notes, and recommendations in order to find the most valuable references through the collective choices of their peers. As such, simply by looking at what peers are reading, you will be able to find the most valuable and relevant scholarly content for yourself; in the meantime, your choices also inspire your peers. Social reference management implements social filtering by crowdsourcing the inputs of readers and building a large-scale user-generated folksonomy, which is different from formal taxonomy and computational search engines. As Brown & Boulderstone (, 2008) argues, social referencing provides a more human-centric, efficient and trustworthy alternative for searching and selecting references.

The "publish then social filter" system challenges the traditional quality control, gatekeeping and certification of scholarly publishing. Open publishing believes that diversity of scholarship and an equal opportunity for every academic voice to be heard, are more important than filtering and restricting the content available for communication in advance and through minority peer review and publishers’ gatekeeping processes. These emerging academic platforms trust their readers’ capacity to judge the quality and value of academic content and draw on what James Surowiecki has called “the wisdom of crowds” to decide on what is the best work in scholarly contexts. As such, the emerging open system also follows the principle of “peer review”, but it tries to reorganize and democratize peer review by expanding the scale of “peers” and making it more transparent.

Challenges

Brown and Boulderstone (2008:302) believe “the expansion of user generated media (UGM) into scholarly publishing – the grass roots creation and dissemination of information without formal organizations structuring such interaction" will be the next big challenge for scholarly publishing communities. As open publishing leads to the “disintermediation by authors, editors and libraries” (Cuel et al., 2009) in traditional publishing value chain, some also predict that this will “remove the need for the intermediary services provided by publishers” (Earl, 2008:206).

However, much of the disruptive potential of the open architecture of the Internet remains latent in the real world of scholarly publishing. Despite the progress in open publishing, the fundamental functions of scholarly

[18] http://partiallyattended.com/2011/10/03/megajournals/

publishing (the review and evaluation process, the precedence of authorship, the academic evaluation, and the dissemination and preservation of scientific knowledge) are less affected by the open initiatives (Campbell & Poppalardo, 2010; Camussone, Cuel & Ponte, 2011; Ponte & Simon, 2011). Ware (2009) argues that, though open technology "offers tremendous potential to enhance scholarly communication", the absence of appropriate adoption reduces its suitability and viability.

Quality is a primary concern. Traditional "double blind" peer review is the most widely accepted means to assess and control the quality of scholarly content. Some value the power of networked communication, collective intelligence and crowdsourcing in post-publication quality control (Benkler, 2006; Potts, Hartley et al. 2008). However, the innovation of peer review harnessing social filtering mechanisms still needs to be improved and formalized in order to meet academic rigors. Ponte and Simon (2011:149) examine scholars' attitudes toward "collaborative and Web 2.0 inspired" models, arguing that though "there is a strong positive attitude" the major challenge resides in the combination of open approaches with "robust and reliable quality control mechanisms".

Open publishing is also challenging "scholarly legitimacy through credentialing, peer review, and citation metrics" (Maron & Smith, 2009). Legitimization of research claims has become a crucial function of traditional academic publishing, which works to formally establish a scholars' claim to their contribution of new knowledge and an intellectual basis for scholarly prestige. As such, the number of refereed publications by the traditional academic publishing system and the impact factors of journals remain primary screening mechanisms for academic employment, appointments, grants and promotions (Katerattanakul, Han & Hong, 2003). Academics hold careerist concerns of "publish or perish" and hesitate to devote into open publishing initiatives which might not reward them practically (Ponte and Simon, 2011; Waldrop, 2008). This is a major challenge for the uptake of open publishing in scholarly communication. In other words, the development of open publishing requires a co-evolution of research impact assessments and relevant university policies. The emerging alternative metrics based on social filtering and the changing policy concerns like "assessing the wider benefits arising from university-based research" [19] will help to build a supportive environment for open publishing in future.

Conclusion

Boyer's model of scholarship includes four major categories: discovery, integration, application, and teaching, which also defines a broad domain of scholarly communication. The interactive, participative, and collaborative open publishing system is not only a medium for publication or a source of open educational resource, but an integral part of collaborative learning, open education, and open science. In the open and networked environments, they are all establishing a system based on "the co-production of knowledge goods and services" (Peters, 2010) among researchers, publishers, students, teachers, and the general public. The dynamics that drive evolutionary changes in scholarly publishing have little difference from those that transform education and science towards a more open and collaborative future. Likewise, they have similar challenges and barriers to overcome, for example, quality control in open knowledge communication, the certification/credentialing of open outputs (either open publications or open courses), the resistance from the traditional and the established institutes, and so forth. The viable innovations developed in one area are thus inspiring to others and a cooperative framework amongst them is expected to form in the near future.

As such, it will be meaningful both academically and practically to link open publishing with a wider open knowledge communication context and examine its role in the open futures of digital scholarship as well as scholarly communication. Possible research directions include two aspects. One is how to effectively use open publications and harness the dynamics of open publishing in learning and teaching, in particularly, how to address the quality issues and customize the open educational resources for specific education needs. The other is how to improve the viability and sustainability of open publishing in the wide context of digital scholarship instead of the scholarly publishing industry only. The interaction, convergence, and co-evolution between open publishing, collaborative learning, open education, and open science deserve more academic attention.

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[19] http://apo.org.au/research/assessing-wider-benefits-arising-university-based-research

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Looking back to look forward: Creating and sustaining peer connections through digital communities

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Digital communities provide opportunities to engage with local, national and international communities of learners or colleagues around a particular domain of practice. This paper briefly describes an adapted communities of practice model used to structure digital communities for a professional association's peer mentoring program. Methods and techniques for the facilitation and leadership of digital communities are explored and findings from two evaluations of the program are examined to identify successes and areas of improvement. Recommendations for future opportunities are also proposed.

Keywords: peer mentoring; digital communities; barriers; motivation, engagement.

Introduction

Peer support and collaboration provide means to address isolation and build knowledge, skills and expertise. Communities of Practice (CoPs) have emerged as non-hierarchical structures that offer contexts for the formation of peer connections that support sustained learning and collegiality situated in shared practice (McDonald, Star, Burch, Cox, & Nagy, 2012). Wenger (2010) defines CoPs as groups of individuals who share their interests and problems around a specific topic and gain a greater degree of knowledge of and expertise in a topic through their regular interaction (Probst & Borzillo, 2008). Early work on CoPs posited that the concept was one of unstructured learning through unstructured social connections within a shared field of practice. It was not thought that communities should have any formal or semi-formal structure which implied that such communities were not led, managed, or facilitated (McDonald, Star, & Margetts, 2012).

More recent work, however, has introduced the concepts of facilitation, leadership, management and organisational involvement. Agrawal and Joshi (2011) found that CoPs need a leader who is responsible for driving, promoting and steering the CoP in the right direction; community leadership positively affects community effectiveness. Ortquist-Ahrens and Torosyan (2009) similarly argued that effective facilitation is essential to creating and sustaining an environment in which learning communities can thrive. A learning community facilitator must, they observed, find ways to help establish a climate that is conducive to genuine inquiry, learning and productivity.

In this paper, a Community of Practice model focused on the growing of community, sharing of practice and building domain knowledge that had experienced great success in face-to-face settings was applied in a digital community context. Participation in digital communities draws on the premise from social learning theory that we are social beings, who learn best in social contexts (Vygotsky, 1978; Wenger, 2010). This application was used with the ascilite Community Mentoring Program which provides a mechanism to link more experienced educators and researchers in a mentoring relationship with early career professionals. An evaluation of the Program was undertaken in 2011 to identify successes and potential limitations of the Program. A follow up evaluation has recently been conducted and this paper also reports on those findings in order to support and guide future planning.

Three-element model in a digital environment

In 2011, the three-element CoP model was trialled in a digital environment with ascilite's pilot Collaborative Community Mentoring Program. Mentoring can play a beneficial role in enabling participants to increase knowledge and experience, enhance career prospects and improve job satisfaction. There are few experiences as powerful as connecting with other people who are united by the need to work collegially and to resolve mutually shared problems. The Collaborative Mentoring Program matched a pair of consulting mentors who had devised a shared theme concept with up to six corresponding mentees who had their own projects that fitted within or related to the proposed theme. This resulted in a group of peers who worked collaboratively and creatively in interdisciplinary teams on shared questions and challenges. The Program aimed to engender an environment that was safe and non-judgmental that promoted the sharing of perspectives and experiences and fostered trust among participants.

It was important that the Program be flexible enough to accommodate a range of needs/proposals. A dedicated area for the Program was hosted in the association's Moodle environment and was used for social interaction, focused discussions and the sharing of ideas, resource building and planning, seeking and providing feedback, and linking to the web conferencing facility where synchronous gatherings were conducted. In addition to the Moodle application, participants were encouraged to use other media for communication, information sharing and knowledge construction including Skype, Facebook, Twitter, and other applications.

Evaluating the model in a digital environment

The results of the first evaluation revealed that the Program was highly valued by the participants and the digital CoP enabled peer support and collaboration by providing access, convenience, flexibility, utility, speed, and cost-effectiveness. Participants acknowledged that "new networks, relationships and ongoing partnerships [were] forged from opportunities gained from being involved in the program" (Reushle, 2012, p. 4). They appreciated the opportunity to have intellectual conversations around shared areas of interest, getting confirmation that their ideas were valid as well as having somewhere to share their professional frustrations. One participant noted that the collaborative mentoring program was particularly successful by observing that "what can (and has) been achieved as a group is much more than what could be achieved as individuals in silos". Their access to more than one mentor added to the breadth and depth of advice.

On the other hand, some participants indicated a lack of sustained engagement with the community. One participant noted "the difficulty in making the program a high priority. It kept slipping down the list of things to do". Another noted that "it seems like 18-24 months would be best for this program. The year just flew away. If it were an extended collaboration in the digital space then definitely it will be beneficial and a good round off for our projects". Extending the duration of the program was a recurring theme in the evaluation. One participant asked, "Does ascilite consider there to be a progression through the mentoring program … would the participants be considered down the track taking on a mentoring role?" Another respondent also noted the difficulty of creating and sustaining the motivation levels of the Program participants: "I often felt distracted from my project goals and, due to conflicting demands on my time, this made me feel frustrated that I could not progress my project outcomes. Although I felt fully supported, I was not fully committed" (Reushle, 2012, p. 5).

It was also noted that the relationships that are formed between mentors and mentees do not appear to be sustained beyond the official duration of the program. The evidence suggests that there are two factors that contribute to the "fading-out" of these relationships:

1. The objectives set by the mentor and mentee at the beginning of the Program are achieved and so the relationship comes to a logical end; and
2. The lack of a leader, or facilitator, inevitably results in the termination of these collaborations.

Leadership in a digital environment

The results of the initial evaluation showed that once the objectives of the group had been achieved, sustaining the engagement of the community was difficult, despite an expressed desire for the collaborations to continue beyond the duration of the Program. Despite there being no reason why the CoPs could not continue once the official Program had ended, participants acknowledged that they did not continue to engage with their networks after that time. While traditional CoPs were thought to be self-managing, with little or no structure (Wenger & Snyder, 2000), more recent studies (Cox, 2006), and the results of this evaluation, show that leadership has a significant impact on the CoP success.

In a study that explored the role of the facilitator in a Community of Practice, it was noted that their first role is to serve the group and create opportunities for members to achieve their individual and collective goals (Dale, 2011). Facilitators should encourage members to take responsibility for the tasks and processes needed to foster effective group work. The results of the latest evaluation of the mentoring program support the importance of this more structured approach.

Evaluation: Stage 2

In order to attract and enhance users' commitment to participation in online communities, it is necessary to know what types of motivations are important for the members. In 2013, the authors (one the leader of the mentoring program; the other a mentee participant in the 2012 program) revisited the literature and conducted a survey of past participants in order to identify the aspects of the mentoring program (one-to-one and two-to-many arrangements) that the participants perceived as successful, and the potential issues.

The survey was made-up of both multiple choice and open-ended questions. Completion of the survey was voluntary and the participants were given a two-week time frame in which to submit their responses. Of the 35 former mentors or mentees from the Program in 2011 and 2012, 25 responded, yielding a participation rate of 71.5%. At the end of the two-week period, data were collected and analysed and key themes were identified.

Results and discussion

Of the 25 respondents, 10 mentors and 15 mentees completed the survey. In order to assess the perceived value of the Program, participants were asked to indicate the extent to which they agreed or disagreed with a series of statements using a Likert scale. The participants were asked to indicate "To what extent do you agree/disagree with the following statements". 24 survey respondents agreed that the Program was a valuable experience, while none disagreed. 1 respondent believed that the Program was valuable for the mentee but not the mentor, compared to 19 who disagreed. No respondents agreed that the Program was valuable for the mentor but not the mentee, whereas 20 disagreed. 22 respondents agreed that the Program was mutually beneficial for both the mentor and mentee and none disagreed. 24 respondents said that they would recommend the community mentoring program to others and no respondents disagreed.

Participants' answers to each of the five open-ended survey questions were examined for themes regarding the successes and/or drawbacks of the mentoring program. To analyse the open-ended questions, an independent rater read through all the responses in order to identify themes that were present. The participants were asked: "Why did you choose to participate in the CMP?" The most frequent response to this question was for networking and collaborative opportunities, with the aim to attend the ascilite conference at the end of the year. One participant said that "I thought it would provide an opportunity to work with someone, to publish and to achieve goals that were set". Another participant said that they hoped that the Program would "provide the incentive to produce a paper for a conference". The participants were asked to outline the objectives that were established for the mentor/mentee relationship at the commencement of the Program. The most common objective was the production of peer-reviewed papers and journal articles that would enable them to take part in the annual conference.

Participants were asked to indicate aspects of the Program that worked well and aspects that did not work well or could benefit from improvement. Of the positive aspects of the Program, establishing goals and objectives and achieving them was said to be the most rewarding aspect. One respondent said that they "relished planning together, outlining objective goals, individual challenges, executing separately and regrouping for evaluation, feedback and then setting the next goal".

In terms of aspects of the Program that the participants felt did not work well, a lack of time and the difficulty of sustaining relationships were the most common responses. One participant lamented that "I haven't really kept in touch with my mentor since the program (I suppose my work demands have taken me in a different direction to the project we looked at)". Another respondent noted "there is never enough time", which was supported by another respondent who similarly acknowledged the difficulty of "finding times when everyone could attend". Following the annual conference, which signified the "official" conclusion of the mentoring program, the majority of partnerships came to an end.

The survey respondents also made a number of suggestions for how the Program could be improved, noting in particular the importance of setting clear goals and objectives (“insist on tangible outcomes e.g. a conference paper for ascilite or journal paper” and “encourage presentation of outcomes at a subsequent conference, as well as the progress one in the year of the mentorship”); and allowing participation in the Program beyond one year (“extend the duration officially to two or three years”). The need for an ongoing leader and/or facilitator (“Perhaps offering more ideas/ guidelines for the new participants” and “more guidance from the program leader”) highlighted the importance of the facilitator’s role in the sustainability of communities indicating that it is the role of the facilitator, in conjunction with the setting of objectives, which have significant bearing on the success (and potential sustainability) of the Program.

The literature often recommends building new Communities of Practice on already existing networks as it is assumed that these networks will provide a solid basis for the new CoP (Dube, Bourhis, & Jacob, 2005). The findings of this study suggest, however, that meeting one’s mentor or mentee in advance made little difference to the sustainability of the Program. The respondents who said that they had met their mentor/mentee were asked to indicate whether they would have agreed to take part in the Program if they had not previously met. 10 respondents said that they would have participated regardless, while 2 said they would not. This suggests that, in general, even those who had existing relationships did not believe that it was necessary or beneficial for the success of the Program.

The importance of setting objectives was a recurring theme in the open-ended questions, which the participants saw as a positive of the Program. However, despite acknowledging that setting clear goals increased their motivation to participate in the Program, only one of the respondents noted the importance of setting new objectives as the initial goals were achieved: “Planning together, outlining objective goals, individual challenges, executing separately and regrouping for evaluation, feedback and then setting the next goal”. Wenger and Snyder (2000) described Communities of Practice as “groups of people who share a concern…and who deepen their knowledge and expertise in this area by interacting on an ongoing basis…[As they] accumulate knowledge, they become informally bound up by the value that they find in learning together. Over time…they become a community of practice” (p. 79). The results of these evaluations suggest, however, that without appropriate facilitation and the continued forming and reforming of objectives, these participant relationships will not be sustained long-term.

Conclusion

In this most recent evaluation study, the participants in the ascilite mentoring program in either 2011 or 2012 completed a non-compulsory survey that was aimed at determining the perceived benefits of the Program and the areas that could be improved for future iterations. The data suggest that clear objectives provide members with roles, responsibilities and planned outcomes which motivate them to contribute to the communities more actively. Once the objectives that are established in the goal-setting agreement have been achieved, the relationships tend to come to a close suggesting that clear goal setting and the role of the facilitator are crucial to the continued activity in the community. Although Communities of Practice are often defined as spontaneously emerging groups, it is now widely believed that organisations have an important role to play in facilitating their emergence, supporting their development and sustaining their activities (Bourhis et al., 2005). How to achieve this in an association reliant on voluntary membership and engagement continues to present challenges and opportunities for more exploratory work.

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Using online learning modules to fight against antibiotic resistance in Australia

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NPS MedicineWise and the Australian Commission on Safety and Quality in Health Care (ACSQHC) have launched a series of online learning modules designed to help combat antibiotic resistance in hospitals. The aim of the modules is to fill a previously unmet need for an online teaching resource on a common curriculum for hospitals and universities. The modules address specific areas where antibiotic use in hospitals needs improvement. Problem Based Learning has been used as pedagogical approach for the modules. Clinical scenarios are presented with a logical progression of tasks including clinical assessment and diagnosis, investigations, interpretation of results, and antibiotic selection. Expert advice and feedback has been incorporated at each step, helping to improve learning outcomes. Learners can access the modules at their own pace and revisit them upon completion. We report, for the first time, participants' perceptions of the antimicrobial modules as learning resource, usability issues, and possible areas of improvement.

Keywords: Antimicrobial prescribing skills, e-learning in healthcare.

1. Introduction

The widespread use of antibiotics promotes antibiotic resistance. As a consequence, standard treatments become ineffective, and infections persist and may spread to others (Enne et al, 2001). The burden of antibiotic resistance is shared by the community. Infections caused by resistant bacteria need to be treated with costly second- and third-line antibiotics. In emphasising the scale of the problem, the World Health Organization recently warned of a return to the pre-antibiotic era if bacterial resistance to antibiotics continues to develop unabated.

Antibiotic resistance can persist within populations (Sundqvist et al, 2010). In order to preserve the effectiveness of antibiotics, and minimise the prevalence of resistance when it does emerge, prescribers are advised to use an antibiotic: (1) when benefits to the patient are likely to be substantial; (2) of the narrowest spectrum to treat the likely pathogen, as recommended by local guidelines and pathology providers; (3) at the appropriate dose and for the appropriate duration.

Experts at the Antimicrobial Resistance Summit in 2011 agreed that educational initiatives need to define antimicrobial resistance as an urgent public health issue (Gottlieb & Nimmo, 2011). NPS MedicineWise identified online learning as an alternative approach to showcase effective prescribing practices, promote dialogue on critical issues in the field, help students to apply theory to practice, and create enthusiasm and confidence in the learner to implement safe practices. Prescribing is an important part of medical practice, but may not necessarily be a strong focus in the training of medical students or other health professionals. Safe-prescribing skills and awareness of medication errors is required by all members of the health care team, and should be a core component of undergraduate and postgraduate training programs (Coombes et al., 2008).

The antimicrobial modules are a web-based course founded on the World Health Organization's *Guide to Good Prescribing* (de Vries, 1994). The resource currently comprises four modules covering Surgical Prophylaxis, Catheter-Associated Urinary Tract Infection (CAU-TI), Bacteraemia, and Community Acquired Pneumonia (CAP). The modules have been designed for individual self-paced learning, or can be used as part of small group work. Module content is written by subject-matter experts and undergoes a rigorous peer-review process, similar to that followed by peer-reviewed journals, during its development. Educational designers review the content to ensure that it is appropriate for online delivery, and that the tasks are meaningful and meet the learning outcomes. Evaluators at NPS MedicineWise design formative and summative research to gather the impact of the modules on students' knowledge construction and to find areas of improvement. The main audience for the antimicrobial modules are prescribers (medical graduates) in their first two years post graduation. However, the program is being use by other prescribers such as nurse practitioners as well as hospital pharmacists.

The modules have been designed as a logical progression where learners can engage in their own way with their patients, discuss therapeutic goals with their peers, choose the optimal non-drug and drug therapy, prescribe medicines, and get expert feedback. Additionally, learners can advise the patient how best to use the chosen therapy and finally, test the knowledge gained using review questions built in with experts' feedback at the end of the module. After completion, the learners can revisit the modules and can print My Formulary, which contains the drug classes and prescribed medicines used across the different modules.

The antimicrobial modules' aims: (1) Filling an unmet need for an online teaching resource which is accessible to all prescribers and which forms a common curriculum for hospitals and universities to teach the principles of safe and appropriate antimicrobial prescribing; (2) Providing a teaching resource that is endorsed by experts and addresses problems in the prescribing of antimicrobials known to drive the development of antimicrobial resistance; and (3) Contributing to the overall effort of antimicrobial stewardship in containing and improving the quality of antimicrobial use in Australia.

Problem Based Learning (PBL) was identified as the pedagogical approach for the antimicrobial modules. This approach was considered to be the most suitable to overcome the gap between traditional didactic lecturing and the clinical reality that students would eventually face, so we decided to base their instruction on real-case scenarios. Students will need relevant medical knowledge to solve a clinical problem presented on the module. Since the instructors at McMaster University's Faculty of Medicine developed Problem-Based Learning in 1969 (Albanese and Mitchell, 1993; Vernon and Blake, 1993), this pedagogical approach has proved to be successful in the area of medical education. Currently, 70% of medical faculties in the US use PBL in pre-clinical years (Kinkade, 2005). PBL has been successfully implemented in various disciplines, such business (Stinson and Milter, 1996), education (Duffy, 1994), law (Driessen and Van der Vleuten, 2000), social work (Boud and Feletti, 1991), engineering (Fink, 1999; Woods, 1994) and physics (Williams, 2001).

2. Aims of the study

The aim of this study was to gauge participants' perceptions of module content and usefulness, access to experts' feedback, knowledge construction, and technical issues.

3. Materials and methods

3.1 Learning Design

A typical antimicrobial module has the following logical progression: (1) Introduction to the condition and learning outcomes; (2) a context/case study that defines who and where the learner is for the purpose of the module; (3) a list of short-term therapeutic goals where learners can nominate, vote, and see their peers' votes; (4) expert feedback on therapeutic goals as guidance; (5) consideration of a non-drug treatment and submission of answers followed by expert feedback; (6) choice of the appropriate drug treatment for the condition; (7) verification of the suitability of the treatment; (8) selection of drugs and prescription online followed by expert feedback; (9) feedback on incorrectly prescribed drugs that may cause adverse reactions; (10) monitoring of patient progress via multiple choice questions and instant expert feedback; (11) provision of information to the patient followed by the expert's ideas; and (12) a multiple choice quiz to give a quick review of the module. Every time learners submit their answers they will get instant expert feedback.

The antimicrobial module follows the three essential characteristics of good learning design according to Britain (2004): (1) learning is active; (2) activities are presented in a logical progression; and (3) the template is reusable. The delivery method is for self-paced learning, but it is flexible enough to be used in face-to-face tutorials. In fact many academics introduce the modules in tutorials at the beginning of the semester and provide the login details to students.

As the antimicrobial modules content is written by content experts with vast clinical experience, the case study presented in each module is authentic. The tasks and the level of interaction promote conceptualisation of the patient, development of critical thinking and problem-solving skills, consideration of different options for treatment, and the meaning of feedback.

3.2 Technical specifications

We have developed our modules using Flash professional and they are hosted on a commercial Flash-based e-learning platform. Each module takes learners approximately one hour to complete. Learners access the modules through a self sign-in process, organised through their universities. The main features of the antimicrobial modules website, where the modules are contained, can be summarised as: (1) self-registration for students; (2) drugs tool; (3) My Formulary tool; (4) prescription writing tool; (5) authoring tool; and (6) monitoring tool.

3.2.1 Self-registration for students
The educational designer at NPS MedicineWise creates a group for each university or organisation on the database. Inside these groups, cohorts are created upon academic request at the beginning of each semester. When a cohort is created and modules are included, the educational designers assign a course key and email sign-up instructions for students to relevant academics. Students of each of these organisations have to self-register into their university and course. The self-registration page can be found at *nps.org.au/antimicrobial modules*.

3.2.2 Drug tool
The drug tool is a database that is organised by clinical condition and is classified into drug classes. A drug class might have many brands of products under it. Each product comes with information such as efficacy issues, safety issues, commentary, and resources. Inside the drug class there are different types of products available, and the database contains details such as drug name, form, strength, directions, quantity, repeats, cost, other issues, and commentary. Links with additional information are placed inside the drug tool. Most of the links comes from the Australian Medicine Handbook (AMH), Therapeutic Guidelines (eTG) and NPS website. This is an example to visualise the structure of the drug tool; *Drug Class> Anti-infectives > antibacterials > aminoglycosides > drug name: Gentamicin.* Each module has a drug tool that allows learners to choose a medicine at the time of prescription.

3.2.3 My Formulary tool
This is a centralised application that takes input from the drug tool. It stores the drug choices from students as well as their notes and which modules they have chosen them from. It also implements a My Formulary page that will display the drugs that the students have added to it (when and by which module they have added them). Additionally, the My Formulary tool provides data for the Write Prescription tool, so the student can choose which drugs they need to prescribe.

3.2.4 Writing prescription tool
This is a tool that allows students to complete and submit an online prescription for the drugs they selected for their patient in a previous step. When they submit this prescription they will get expert feedback. Learners are able to search for drugs in their formulary, select drugs for the prescription, enter doctor, patient and drug details into the prescription, preview and print the prescription (if desired), and get feedback from an expert on the correct prescription. The prescription tools have the same fields as those used in Australian public hospitals and general practice, and look similar.

3.2.5 Authoring tool
This area is exclusively for the educational designer and contains the sequence of activities covered in the learning design part. This section allows the designer to build the series of interactions the module will follow.

3.2.6 Monitoring tools
This section is for academics who want to see their students' progress. The grade book is a functionality that allows gathering of information from the whole cohort and that reports on a spreadsheet the activities of all the students inside the cohort, particularly currently visited and completed modules.

4. Methodology

A cross-sectional questionnaire containing eleven questions was designed and embedded at the end of the modules as an optional activity. The questionnaire captured demographics of participants, content and completion of modules, student's attitude, perception of usefulness, and technical difficulties.

5. Results and discussion

5.1 Demographics of participants

A total of 1291 valid surveys were received. Participants included medical students (67.4%), and hospital doctors (32.4%). Their level of practice was: interns (75.9%), resident medical officers (17.4%), and registrars (5.2%). Ninety-four percent of the participants obtained their medical training in Australia. Table 1 presents the completion of the modules. Note that a fourth module (Community Acquired Pneumonia) was added recently, and no data was yet available during the writing of this paper.

Table 1: Completion of modules

	% (n)
Surgical prophylaxis	37.6% (769)
Catheter-associated urinary tract infection	25.3% (517)
Bacteraemia (line sepsis)	37.1% (757)

5.2 Content of the modules

Almost 96% of participants agreed that the learning objectives of the modules were clear, and 96% agreed that the tasks addressed these learning objectives. Ninety-two percent found these tasks to be engaging, while 90% agreed that the content was clearly presented. Most of the participants (97%) agreed that the modules reflect real life situations (Table 2). This was a remarkable response which may be explained by the fact that the modules were written by subject-matter experts and had undergone a rigorous peer-review process, similar to that followed by peer-reviewed journals, during their development. Additionally, educational designers had a key role in ensuring that the content was appropriate for online delivery, and that the tasks were meaningful and met the learning outcomes.

When participants were asked how difficult the modules were, 81.3% responded that they were just right, 10.8% said they were easy, 0.9% said they were too easy, 6.8% said they were difficult, and only 0.2% said they were too difficult.

Table 2: Participant's perception on content of the antimicrobial modules

	Strongly disagree	**Disagree**	**Agree**	**Strongly agree**
	% (n)			
The learning objectives were clear	1.8% (37)	3.0% (62)	77.8% (1589)	17.4% (355)
The module tasks addressed the learning objectives	1.8% (37)	2.6% (54)	77.5% (1584)	18.0% (368)
The module tasks were engaging	2.1%	6.4%	73.3%	18.3%

	(43)	(130)	(1497)	(373)
The content in the modules was clearly presented	2.8% (58)	7.0% (143)	71.5% (1461)	18.6% (381)
The case study in the module reflects a real life situation	1.9% (39)	1.2% (24)	70.8% (1447)	26.1% (533)

	Medical student	**Hospital doctor**	
	% who agree/strongly agreed		
The learning objectives were clear	95.9% (1326)	93.5% (618)	P=0.016
The module tasks addressed the learning objectives	96.6% (1335)	93.3% (617)	P=0.001
The module tasks were engaging	92.5% (1278)	89.6% (592)	P=0.027
The content in the modules was clearly presented	*No significant difference*		
The case study in the module reflects a real life situation	97.7% (1350)	95.3% (630)	P=0.004

There were no significant differences in the responses to these questions between the different modules.

5.3 Usefulness of the module

Ninety-seven percent of participants found that the antimicrobial modules were relevant to their clinical experience, while 92% thought the module tasks tested their understanding of the topic rather than just their memory. The modules had links to resources such as the Australian Medical Handbook (AMH) and Therapeutic Guidelines (eTG), and 89% of the participants considered them useful. Additionally, ninety percent of participants thought the modules were effective for developing critical thinking skills (Table 3).

Table 3: Participants' perceptions of the usefulness of the antimicrobial modules

	Strongly disagree	**Disagree**	**Agree**	**Strongly agree**
	% (n)			
The module was relevant to my clinical experience	1.3% (26)	2.0% (41)	71.7% (1464)	25.0% (511)
The module tasks tested my understanding of the subject area, rather than just my memory	1.6% (32)	6.5% (132)	74.3% (1518)	17.7% (361)
The module links to other resources were useful	1.6% (32)	9.1% (186)	72.7% (1485)	16.6% (340)
The module was effective for developing my critical thinking skills (e.g. critical analysis, problem solving)	1.7% (35)	8.0% (164)	75.6% (1544)	14.6% (299)

	Medical student	**Hospital doctor**	
	% who agree/strongly agreed		
The module was relevant to my clinical experience	97.5% (1347)	95.0% (628)	P=0.003
The module tasks tested my understanding of the subject area, rather than just my memory	*No significant difference*		
The module links to other resources were useful	87.9%	92.3%	P=0.003
The module was effective for developing my critical thinking skills (e.g. critical analysis, problem solving)	*No significant difference*		

There were no significant differences in the responses to these questions between the different modules.

5.4 Access to feedback

Eighty percent of participants agreed that having access to peers' answers was useful, while 98% agreed that built-in expert feedback was useful. Most (93%) of the participants said that the levels of feedback were adequate to guide the decision-making process during completion of modules (Table 4).

Table 4: Participant's perception on access to expert feedback in the antimicrobial modules

	Strongly disagree	Disagree	Agree	Strongly agree
	% (n)			
Having access to my peers' answers/ideas was useful	3.0% (61)	16.1% (328)	67.8% (1386)	13.1% (268)
Having expert feedback was useful	0.6% (12)	1.2% (25)	50.6% (10.34)	47.6% (972)
There was adequate feedback in the module to guide my decision- making process	1.2% (25)	6.0% (122)	69.5% (1420)	23.3% (476)

Only the attitude to access to peer responses was significantly associated with the learner type and module. Hospital doctors were more likely to agree or strongly agree that access to peer's answers and ideas was useful (88.5%, compared to 77.4% for medical students; $P<0.001$). Learners who completed the surgical prophylaxis module were less likely to report that they found access to peers' answers was useful (Bacteraemia 83.2% agree/strongly agree, catheter-associated UTI 82.2%, surgical prophylaxis 77.9%; $p=0.021$)

5.5 Knowledge construction

In regards to knowledge construction, 96% of participants in this study considered that their knowledge of the antimicrobial topic had improved, while 94% agreed that they have a better understanding of the reasons for prescribing particular antibiotics for specific conditions. In contrast, 59% of participants believed they needed more information to better understand the advice given in the modules. Additionally, 87% of participants thought they were now more likely to consider unwanted consequences of antimicrobial prescribing (Table 5).

Table 5: Participants' perception of knowledge construction after completion of antimicrobial modules

	Strongly disagree	Disagree	Agree	Strongly agree
	% (n)			
My knowledge of the antimicrobial topic has improved	0.7% (15)	3.6% (74)	76.3% (1558)	19.4% (394)
I have a better understanding of the reason for prescribing particular antibiotics for specific indications	0.7% (14)	5.4% (110)	73.8% (1570)	20.2% (412)
I needed more information to better understand the advice given in the module	2.7% (55)	38.2% (780)	49.0% (1001)	10.1% (207)
I am more likely to consider unwanted consequences of antibiotic prescribing such as increased antimicrobial resistance	1.3% (27)	11.8% (241)	75.1% (1535)	11.7% (240)

	Medical student	Hospital doctor	
	% who agree/strongly agreed		
My knowledge of the antimicrobial topic has improved	96.6% (1335)	93.6% (619)	P=0.002
I have a better understanding of the reason for prescribing particular antibiotics for specific indications	94.9% (1312)	91.8% (607)	P=0.006
I needed more information to better understand the advice given in the module	57.2% (791)	63.1% (417)	P=0.012
I am more likely to consider unwanted consequences of antibiotic prescribing such as increased antimicrobial resistance	*No significant difference*		

	Surgical prophylaxis	Catheter-associated urinary tract infection	Bacteraemia (line sepsis)	
	% who agree/strongly agreed			
My knowledge of the antimicrobial topic has improved	*No significant difference*			
I have a better understanding of the reason for prescribing particular antibiotics for specific indications	*No significant difference*			
I needed more information to better understand the advice given in the module	61.8% (475)	62.1% (321)	54.4% (412)	P=0.004
I am more likely to consider unwanted consequences of antibiotic prescribing such as increased antimicrobial resistance	85.8% (660)	90.1% (466)	85.7% (649)	P=0.04

5.6 Technical/navigation issues

Overall, 88% of participants did not experience technical issues while 12% reported problems. The study did not gauge the type of technical issues on the survey, and this is one of its limitations. Nevertheless, we have a helpdesk at NPS MedicineWise for similar modules (NPC modules), and 70% of the calls are about problems related to the Flash version, 20% are about the Java platform, and 10% about browser compatibility. Ninety percent of participants agreed that the modules were easy to navigate, and 94% thought the instructions in the modules were easy to follow (Table 6).

Table 6: Participants' navigation issues while completing the antimicrobial modules

	Strongly disagree	**Disagree**	**Agree**	**Strongly agree**
	% (n)			
It was easy to navigate through the module	2.5% (25)	8.0% (79)	66.8% (661)	22.7% (225)
The instructions in the module were easy to follow	0.9% (9)	5.2% (52)	70.7% (701)	23.1% (229)

5.7 Antimicrobial modules' uptake by health professionals

The antimicrobial modules were launched to health professionals in October 2012. Participants interested in joining the modules visited the website at www.nps.org.au/npc and followed the instructions to get access to the modules. So far we have good uptake, with 500 users and 394 completions in the first two months. We received several emails from users reviewing the modules. Most of them were positive, as for example:

> *I think the antimicrobial modules are relevant, I like the stepwise progression ... they're very thorough.*
>
> I think that the standard of prescribing both in doctors and medical students needs overall to be improved and I think that the antimicrobial modules are doing an excellent job.
>
> The antimicrobial modules are a very good resource; it presents a logical progression for students to follow when making clinical decisions. I believe it has a lot of interaction that allows students to engage with it in their own way.
>
> I had a look at the surgical prophylaxis and bacteraemia modules and thought that they were pretty good from the perspective of medical students, particularly if aided by a tutor who knows the ins and outs of the prescribing sections and what the voting means.

5.8 Limitations of the antimicrobial modules

There are several limitations of the antimicrobial modules related to functionality, cross-device compatibility, social presence, and multimodal delivery. We are currently working on a strategy to overcome these issues.

The main limitation of the modules is that, for assessment purposes, not all of the interactions are captured on the database. The list of short term therapeutic goals (Step 3 in the sequence), and also the providision of information to the patient (Step 11), are recorded on a database, but this is not accessible to academics on the report. Data on multiple choice questions on considering a non-drug treatment (Step 5), monitoring patient progress (Step 10), and multiple choice quizzes designed to give a quick review of the module (Step 12), cannot be captured. Antibiotics used by participants in different modules can be exported as PDF but academics/supervisors will not have direct access to this information. All of these are technical limitations that need to be addressed in order to promote the modules across healthcare organisations in Australia.

The antimicrobial modules interface is designed in Adobe Flash, which is considered a closed system as Adobe has sole authority as to future enhancement, pricing, etc. Devices running the iOS platform (iPad, iPhones and iPod touch) cannot run Flash content. We are currently investigating the possibility of migrating our modules from Flash to HTML5, CSS3, and JavaScript in the near future. As the level of interactions in the modules is not rich, it is possible to build it with features that are stable and fully supported by modern browsers. With this approach we hope to extend cross-device compatibility, which will help us reach more learners and improve their learning experiences.

It has been confirmed in the literature that one of the major components of student satisfaction in online learning is the level of interaction. High levels of interaction result from highly cooperative learning environments (Simonson et al., 2012). Educators are challenged to seek and implement tools and strategies that recreate face-to-face human elements like cooperation, immediacy, and intimacy, which model physical classroom experiences (Gunawardena & Zittle, 1997). Social presence is the mutual awareness of interacting partners over a communication medium (Short, Williams & Christie, 1976). The modules have a weak social presence and students can only see how their peers replied in the therapeutic goals section (Stage 3) and in considering a non-drug treatment (Stage5). A better way to connect learners may be developing an online learning community promoted by instant messages, where students can create a profile for online discussion and sharing of resources etc. In this space learners can discuss and consider ideas, and learn from each other in a constructive manner. An online learning community of users will help to create social presence, build cohesion, and elevate student's attitudes, performance, satisfaction and student engagement (Ring, 2012).

The antimicrobial modules have been built using a single delivery approach. Learning objects are interactive elements developed in Flash. In recent years, the use of multimedia (videos, podcasts, images etc.) in conjunction with hypermedia, have been successfully applied to many e-learning environments in order to both enhance these environments and to cater for a wider variety of student learning styles (Birch & Gardiner, 2005; Sankey & St Hill, 2009; Sprague & Dahl 2010). Neuroscience research has also revealed that significant increases in learning can be accomplished through the informed use of visual and verbal multimodal learning (Fadel, 2008). In other words, students may feel more comfortable and perform better when learning in environments that cater for their predominant learning style (Cronin, 2009, Omrod, 2008). It has been reported that the use of video cases in PBL scenarios is a valuable stimulus for group discussions by medical students. Students thought the video cases enabled them to create realistic mental pictures of conditions, and provided integrated pictures of patients as people, which challenged them to elaborate the cases seriously and were more memorable than text-based cases (De Leng *et al*., 2007). We are considering including digital video in future modules to describe the case scenarios and possibly the patients concerned. Digital video provides a natural medium for enhancing the sense of context and realism in case studies. It can capture the complexity of real life scenarios and allow students to replay events as many times as they need, and absorb important features that escaped them on first viewing (Reyna, 2010).

6. Conclusion

It has been identified that this technological intervention has good potential to fight antimicrobial resistance. Currently the modules have been rolled out to university students and health professionals. Further studies will be designed in the near future, to gauge the impact of the modules on antimicrobial prescription in hospital settings.

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OpenTab: imagining an open, mobile future for first year business students

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The OpenTab project investigated an open educational (OE) approach to developing course materials using tablet devices (iPads) to access Open Educational Resources (OERs). It explored the implications of applying an open approach to the development of materials for use in the faculty's new common first year core (CFYC) subjects. Conducted in parallel with a trial roll out of tablet devices in a core subject in the School of Business, the project revealed a range of issues that the project team intends to address as it continues to develop a model workflow for other subjects in the university.

Keywords: Open educational resources, business, curriculum design, mobile devices, Enquiry-Based Learning

Introduction

Fulfilling the promises of Open Education

Starting over a decade ago with a strong social justice agenda, the OE movement advocates the opening up of educational resources in order to make them available to everyone. In this way, OE is a means for an information-based society to support equity in education.

With the costs of education on the rise in most countries, making things such as textbooks, videos and online resources as cheap as possible is becoming even more desirable. Open educational resources (OERs) can play a role in providing alternatives to traditional published resources, and in some cases completely replace them. Projects such as Wikipedia have now demonstrated that it is possible to have free resources that are high quality using crowdsourcing.

Creative Commons licenses make it possible to adapt content for different educational purposes, and the future holds great potential for open education resources to be stored in digital libraries in order to be reused and customized.

> Perhaps we are entering a world where learning objects will be at our fingertips. Learning objects on different topics will likely be something you can grab like magazines and newspapers on the way into a plane, bus, or train. (Kim and Bonk, 2006, p. 2).

Another issue that the OER approach has addressed is the problem of keeping learning resources up to date. Textbooks are often redundant as soon as they are published, resulting in reluctance among many students to purchase expensive books which can never be resold.

The authors started the quest described in this paper in 2012 with all of these ideals in mind: social justice, equity, cost reduction, timeliness and adaptability. With all of these potential gains, and despite the development of many successful repositories the OE movement has often failed to connect with teaching staff. Resources remain underutilized and practitioners often effective design skills to integrate them in teaching in meaningful ways (Conole and McAndrew, 2010). We now turn to describing our approach to taking up the challenge of addressing these shortcomings in a business discipline context using a practical approach to subject design involving staff development and support.

OpenTab Project

The La Trobe University OpenTab Project was initiated in 2012, with the aim of adopting an OE approach to developing and publishing course materials for a suite of four subjects making up the common first year core (CFYC) in the Faculty of Business, Economics and Law at the host institution. The CFYC subjects are designed to provide students with a fundamental grounding in a range of disciplines offered within the faculty, allowing students greater flexibility to transfer between discipline specialisations. Because of the cross-disciplinary nature of these subjects, there were no off-the-shelf textbooks, which are being delivered for the first time in 2013. The subjects were developed through a collaborative curriculum design process in 2012 involving teaching staff, academic language and learning staff, and curriculum designers and it was intended that this collaborative environment would also be conducive to the use and production of OER. Each of these subjects is being developed using active learning principles, using various Enquiry-Based Learning (EBL) designs.

The adoption of reusable, modifiable content from open sources was intended to allow bespoke course materials to be provided to students electronically and free of charge via personal computers and mobile learning devices such as iPads. The production of reusable high-quality learning materials as a contribution to the growing bank of OERs worldwide was seen as a useful by-product of this process that would allow the team to demonstrate the institution's ability and skill in engaging with the broader open education community.

The OpenTab project was funded by the university's Curriculum, Teaching and Learning Centre (CTLC) to employ a senior research assistant as an OER specialist for a period of approximately six months.

Mobile Learning Devices Pilot Project

The name of the OpenTab project represents the union of two ideas – 'open' for OE, and 'tab' representing tablet devices. The project was designed to run in parallel with the Faculty's Mobile Learning Devices Pilot (MLDP) project, which is testing a one-to-one tablet device model with the evaluation of a trial deployment of 103 iPad minis to students and staff in first semester 2013. Outcomes of this evaluation inform the OpenTab project and are also reported in this paper.

These twin projects are exploring the ways that mobile technologies may be able to assist, through their flexibility and ubiquity, teachers and learners to engage in collaboration and communication in an active learning context. The purpose for this approach was that the resources and workflows developed by OpenTab would result in open content that could be accessed using tablet devices. Along the way, the projects have demonstrated practical ways to incorporate OERs in mobile learning and providing staff development opportunities in the context of subject design as well as a forum for discussion of the related issues such as access, equity and affordability of learning resources.

Background

History and definition of open educational resources (OER)

Open educational resources (OER), and the philosophies that accompany them, have been in use for more than a decade now. OER was first formally defined by UNESCO in 2002 (D'Antoni, 2009; Wiley & Gurrell, 2009; Wiley & Thanos, 2013). While there is some variation in the definition of OER (Pawlowski & Bick, 2012; Rolfe, 2012), most advocate for the definition outlined by the William and Flora Hewlett Foundation (2012): "OER are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others." ("OER defined", para. 2). OERs are deemed to include open courseware, learning objects, textbooks and journals (Joyce, 2006).

Proponents of OERs highlight the shared philosophies and benefits between open education movement and the open source software movement (Baraniuk, 2008; D'Antoni, 2009; Wiley & Gurrell, 2009). Opening up source code and educational resources to peer contribution demonstrates the ability of peer groups to improve the quality of reusable resources. In the same way that peer review feedback – a process so familiar in the academic world – contributes to the improvement of published materials, allowing peers to contribute their expertise directly to a software codebase or educational resource leads to an improvement of the code or materials (Wiley & Gurrell, 2009).

Underpinning the OE movement is a commitment to social justice in making education accessible to all (Conole, 2012; Joyce, 2006). Some believe that government-funded institutions – such as universities in Australia, New Zealand and the UK – should be more open with the products of their endeavour, including their published academic articles as well as educational materials. This has arisen out of growing acceptance and expectation of openness, particularly with internet materials (Blackall, 2008). Both the OE movement and the increase in adoption of online teaching methods have been facilitated by the broadening reach of the internet.

When open is not open

The proliferation of MOOCs (massive open online courseware), particularly through 2012, introduced confusion around the definition of open. Long-term proponents of OE highlight the distinction between open *access* (or, more accurately, free access) and what is more widely accepted to be a true definition of open, which Wiley states revolves around the four Rs of OER permissions: reuse, revision, remixing and redistribution (Wiley & Thanos, 2013). Those who equate openness with modifiability argue that the move towards providing free and ready access to materials that have restrictions on reuse and modification conflicts with the intentions of the open education movement (Baraniuk & Burrus, 2008; Bissell, 2009; Blackall, 2008; Hilton & Wiley, 2012). Baraniuk (2008, pp. 230-231) states that resources that can be shared but not adapted are "… merely 'reference' materials", and that such practices "… [stifle] both innovation on the materials and also community participation."

The growth of open

The move towards openness in education is matched by a trend towards greater incorporation of online teaching and learning in formal education contexts (McAndrew, Scanlon, & Chow, 2010) and greater proliferation of Creative Commons licensing (Rolfe, 2012; Wiley & Gurrell, 2009). While the global applicability of Creative Commons licensing has facilitated a wide adoption of OER, the literature generally reveals low levels of awareness among academics about copyright and open licensing options (Bissell, 2009; D'Antoni, 2009; Rolfe, 2012; Wiley & Gurrell, 2009).

While permissive copyright licensing options have worldwide reach, levels of re-use of OERs are disappointingly low (Hilton & Wiley, 2012), either because OER systems have limited capability to track reuse or because evidence suggests that OERs are being created, but not harvested for modification. Conole (2012) calls for a greater investigation of OER practices, to ascertain ways to address the low usage rates. An OECD report on OER suggests that a lack of institutional policies on OER "is in many cases related to a lack of knowledge and capacity among administrators and academics in terms of OER and, with regard to copyright and [intellectual property] implications, a reluctance to address legal issues" (Joyce, 2006). The OpenTab project sought to respond to these low-usage issues by exploring how OER can be incorporated in the teaching practices of the faculty, and perhaps the wider university community. Reed (2012) claims that "the success of the open content movement is reliant on wide participation and a critical mass of 'open' content", (p. 1). This idea of a 'critical mass' of content and participants engaged in OER relies on broad collaboration across academia; what Rolfe refers to as a "positive collegiate culture" (p. 1) which, she argues, needs to be supported at an institutional level (Rolfe, 2012).

Benefits of OER in teaching and learning

The literature promotes a wide range of benefits of OER, such as encouraging lifelong learning (Joyce, 2006), improving teaching skills through resource development and adoption of learner-centred pedagogies (Carey & Hanley, 2008; Conole, 2012b; Joyce, 2006; Rolfe, 2012), reducing costs for students and faculties by reducing reliance on commercial textbooks (Joyce, 2006), improved collaboration between colleagues within and between institutions (Joyce, 2006; Rolfe, 2012), reducing barriers to translation of materials into other languages (Hilton & Wiley, 2012), improving accessibility for vision-impaired learners, and keeping educational resources up-to-date by avoiding lengthy (and costly) publishing processes (Baraniuk & Burrus, 2008; Joyce, 2006). Some equate OER adoption with opportunity to improve teaching skills and methods, as well as the opportunity to connect, share and collaborate with colleagues (Baraniuk, 2008; Petrides, Nguyen, Kargaliani, & Jimes, 2008). What is lacking in the literature, however, is evidence of these benefits in practice, and their impact on student experiences. The OpenTab project team plans to address this as the project develops.

Case studies on using and developing OER

While there exists a range of case studies in the literature (Baraniuk, 2008; Rolfe, 2012; Sapire & Reed, 2011), few detail the process of searching for and using OERs, or developing OERs themselves. However, Petrides and Jimes (2008) investigate how a group of volunteers went about developing OERs for use in high school science education in South Africa. What is notable about this case study is the externality of the project. Rather than the educators themselves developing open content for use in their own teaching, the volunteers essentially set up their own publishing house, mimicking the activities of corporate educational publishing. This model encounters the same problems as will always be faced with external content development, namely those with trialling materials in a live classroom situation. If not developed by educators, it is likely the materials may not be fit for purpose in a real educational setting and will require amendment by educators to fit the purpose.

The shortcomings of this approach supports Carey and Hanley's assertion that it is necessary to have a good "pedagogical content knowledge" in order to develop, or compile, OERs (Carey & Hanley, 2008). Carey and Hanley (2008) extend upon Baraniuk's (2008) ideas on the need for a community of practice, noting that the skills required need to be nurtured within educational institutions. Carey and Hanley (2008), as well as Joyce (2006), highlight the importance of developing institutional strategies that support the use and development of OERs. Bossu, Brown, and Bull (2012) call on the Australian government to provide policy support for OER.

Though each of these case studies has a limited focus, together they provide a fuller picture of the practice of developing, using and maintaining OER, and detail the ongoing challenges of sustainability and institutional barriers to OER adoption.

Pilot study

As described above, this study was conducted in conjunction with the development of a new curriculum for a suite of common first-year subjects across all business degrees at La Trobe University as an environment for the introduction of OERs. The study was intended to discover and highlight the requirements for introducing OER into the curriculum.

Methods

Adopting the broad framework of participatory research as described by Adelman (1995), this study used a combination of techniques to initiate, survey and reflect on practice in order to address effective action.

The project began using desk research focusing on the OE movement – its history, development, progress and possible future directions for the development of OERs. The OER specialist developed a model workflow incorporating quality assurance for the location, adaptation and development of OERs and their deployment to mobile devices based on this work.

Two members of the OpenTab project joined meetings of four multi-disciplinary subject design teams. The OER specialist briefed each of the design teams on the principles of OE, and led a discussion on ways in which OERs could be located and incorporated for use in readings and as supporting materials for assignments. Follow up one-on-one meetings were held with teaching staff to discuss more specific examples for incorporation, to answer questions arising from this work, and to provide any further support.

The project allowed small-scale testing in a situation where we could work on specific curriculum elements. We reasoned that choosing first-year materials as a starting point would improve the chances of finding appropriate OERs.

The OE approach was chosen to fit with the enquiry-based pedagogy already decided upon for the four common first year core subjects, with the idea that students may be encouraged to find alternative sources as part of the case-study based enquiries. The project also provided test bed for a wider roll of the OE approach out across the Faculty.

The MLDP project adopts a combination of techniques to investigate and evaluate current mobile learning technologies, including desk research, a staff and student trial of 103 iPad Minis, field notes on the trial, and a survey and a series of focus groups for each of the two trial groups. A small amount of the data collected during the student survey and eleven focus groups (May and June, 2013) relating to the use of textbooks has been reported under 'Student experiences' below.

Findings and discussion

Staff awareness and attitudes

In a recent discussion paper. La Trobe University's Open Education Working Group reported on the low levels of awareness and skills in using OER among various staff members (Bisset et al., 2013). The findings of the discussion paper reflect the observations from the OpenTab project. Similarly, Rolfe (2012) surveyed staff attitudes and awareness to OER in one faculty at a UK university in 2009, as a means of measuring a benchmark against which to assess the progress of OER within that institution. Many of the issues discussed in Rolfe's findings resonate with the OpenTab project experience, such as ownership of materials and lack of confidence and understanding about how copyright operates.

In the same way that Rolfe's survey initiated discussion among staff about OER, so too did the OpenTab project. One of the project's activities was to provide information sessions to teaching staff about OER – what they are, how they can be used, how they differ from content that is freely available on the internet but under restrictive copyright conditions. These information sessions opened up discussions about using free internet resources, which revealed that many staff equate 'open' with 'free' and were unaware of the key principles of OER as defined by UNESCO or by Wiley's Four R principles (Wiley & Thanos, 2013). For some staff, this was their first exposure to the concept of OER. The sessions provided information to staff about how Creative Commons licenses work within the copyright landscape, both in terms of how to use Creative Commons-licensed work and how to share teaching and learning materials using Creative Commons licenses. This discussion necessitated a brief overview of the workings of standard copyright licensing, and an analysis of the literature on OER suggests was an area of low awareness among many university academics. Staff received this information about Creative Commons licensing with an air of concern over the extra level of work that would be required of them if they wished to locate and use truly open resources. Another important finding from (Rolfe, 2012) is also relevant here, and that is the need for collaboration among academics in engaging in searching and repurposing of OER.

These information sessions were held for a specific group of teaching and academic development staff involved in the curriculum design of the CFYC and aimed to provide information on how OER may be incorporated in the design and delivery of subjects adopting EBL pedagogy.

Collaboration

Regardless of the support provided by faculty staff who specialise in OER, collaboration and input from subject-area specialists is required for OER to be integrated into curriculum design. Joyce states that "working in partnership is essential for the effective uptake and dissemination of OER (Joyce, 2006, p. 12), a claim which the OpenTab experience supports. An OER officer with expertise in publishing and production processes cannot replace the value that subject-area specialists bring to educational resource selection. The most important aspect of collaboration in working on OER is that of skills transference from expert to non-expert – or in this case, from OER expert to subject-area expert and vice versa.

Several attempts were made to initiate collaboration between the OER specialist and teaching academics, but in each instance, teaching workload pressures prevented the progress of any such collaboration. In order to test how a universal process may be applied more widely throughout the faculty and the university, the OER specialist undertook what would normally be the role of faculty librarian to search for and locate OER that teaching staff could assess for suitability for the curriculum The aim was to map out what steps would be required in the process and align them to the most appropriate role within the faculty (or other areas) to conduct that work in the future. However, lack of time for teaching staff to review the materials located prevented this process from being fully tested.

This study did succeed however in examining the processes and systems used to develop and deliver a new curriculum, uncovering barriers to OER adoption and development (both internal and external) and revealing a low level of awareness of OER and open education practices. The project was successful in reviewing the current practices for the publication of course materials in the faculty. The review also revealed: opportunities to improve understanding of OER and how they can be used and developed; the high impact the curriculum redesign process had on teaching workloads; a lack of time and skills (perceived or actual) for developing teaching and learning materials; and an imbalance between teaching needs and availability of in-house tools to fulfill those needs.

Publisher agreement

At the time of the study, and independently to the OpenTab project, the School of Business was negotiating with four large publishers to provide learning resources for students through a tender process. The final deal struck involved the provision of a set of readings to students by the publisher (at their expense). This process had a direct impact on the outcomes of the OpenTab project, and the door was closed on discussions relating to the use of open content as this was regarded by some staff in the school as not upholding the spirit of the agreement with the publisher. A compromise was reached involving the location of content for a culminating assessment task in one of the subjects. However this idea was later abandoned by the teaching staff due to lack of time.

This episode of the OpenTab project involving the publisher agreement represents an important finding, in that reliance on third parties,such as publishers to provide additional learning resources can often be done at a cost to students (and, by extension, the library), rather than at a cost to faculties and teaching staff.

Student experiences

Early findings from the MLDP Project feeding into OpenTab highlight students' sensitivities to the question of costs and flexibility of learning resources such as textbooks and electronic texts. In one focus group, the topic of the cost of textbooks versus electronic books came up. The context for this comment was that students were in agreement that electronic texts should be cheaper than textbooks.

> Student: And if it was more affordable then everyone would buy them, that's the thing. In most of my classes, the majority of people don't own the books. I think every group I'm in it'll be one in three that'll have the actual book that's bought it… whereas if they were really cheap and just electronic everyone would get it because it's so affordable there's no point not having access to it. And you'd be able to access it everywhere rather than having to carry it around. Like I know I always carry my books around and then one time, you know, I actually went to use it and I'd left it at home and again it was so inconvenient, whereas if it was all electronic I'd be able to access it.

This comment may not be surprising given the increasing cost of textbooks, however in the context of the specific subject these students were enrolled in the comment has particular relevance. The publisher decided to only offer the electronic version of the textbook as an alternative (more costly) bundle together with the hard copy. As a result, when surveyed, 86% of respondents in the MDLP project said that they had never accessed the electronic textbook for their subject using their iPad Minis. By comparison, using these devices 29% had accessed e-books and e-journals from off campus, and 42% from on campus. Rather than offering a lower payment model in order to increase sale quantities the publisher opted for a model that did not cannibalise its own textbook.

Study outcomes

Barriers

The study revealed a range of barriers to the use and development of OERs within the Faculty. Internal barriers included lack of awareness, lack of institutional or systemic support for OE approaches and lack of clarity on where materials should be stored. External barriers included the fragmentation of OER repositories, lack of 'openness' of materials (restrictions on reuse, modification and distribution) and sustainability of repositories (changing from free access to fee-for-access models).

The internal barriers are indicative of the wider problem of OER awareness in Australia (Bossu, Brown, & Bull, 2011), despite the involvement of a range of Australian and New Zealand universities in OER, such as University of Southern Queensland and Otago Polytechnic, who are members of the OER University, and other isolated initiatives such as University of Tasmania's Adapt project. Rolfe (2012) and Carey and Hanley (2008) call for an institutional strategy and vision regarding the deployment of OER. It became clear to the OpenTab project team that, in the absence of a grassroots movement towards open educational practices within the faculty, a top-down support mechanism would be required to initiate OER usage within the faculty.

Following the initiation of the OpenTab project, OER was introduced as an area of exploration for La Trobe University's Radical Learning Group, which subsequently recommended that OER be incorporated as part of the university's 21st-century education models (Macken et. al., 2012). This created the momentum for a group of staff across a number of faculties and central teaching departments to form the Open Education Working Group, which is addressing wider issues of systemic institutional support for OER and OE practices (Bisset et al., 2013).

The impact that external barriers had on the OpenTab project relate more directly to the sourcing of appropriate materials for inclusion in the CFYC subjects within the faculty. The process of searching for appropriate OER to trial in the project was frustrating. As Wiley and Gurrell (2009) note, quality in OER can be defined in a number of ways, but the true measure of high quality for an OER is its applicability to the specific context for which an educator wishes to use it. Searching established OER repositories for textbook-like materials such as background reading and case studies on the fundamentals of business for an audience of first-year university students proved difficult for a range of reasons. Firstly, it was difficult to locate material of an appropriate level. Often when such material was located, it was found to be restricted by standard copyright protections and therefore could not be modified or distributed. As the project progressed, it became clearer that sourcing usable OERs which were truly open, complete with an appropriate license, was more difficult than the promise of OER had led us to believe. It was an important test, for it proved the reality of the theory we were trying to apply. Eventually, however, some materials were located and sent to a teaching staff member to assess for suitability for use in one of the CFYC subjects. No sooner had that occurred than Flat World Knowledge, where the content was housed, announced that it would be moving to a fee-for-access model for students, which meant the materials had been withdrawn from consideration because free access was a core criterion for the project.

These external barriers provide further evidence for the creation of our own open materials – or the conversion of existing teaching materials to openly licensed materials for wider distribution – as a way to contribute to the OER movement in a meaningful way. Rolfe's study (2012) revealed that a culture of sharing already existed within the faculty, which assumes that original materials already exist which can be shared. There is nothing to indicate that this is not also the case in the Faculty of Business, Economics and Law. A supportive institutional environment is needed to allow for the development of open resources as well as for the assessment of the impact of those resources on teaching and learning practice.

Limitations

The limitations of this study relate primarily to the timing of the OpenTab project in relation to the curriculum design for the CFYC subjects. At the time the OER specialist for the project commenced and the project began in earnest, the formal tendering process for the supply of textbook resources and academic skills diagnostic tools was already underway. By electing to embark on a tendering process, the leaders of the curriculum design initiative had already locked down their options for the supply of educational resources, leaving very little room for OER to be considered as a realistic option. As Bisset and colleagues (2013) and the results of this study demonstrate, introducing OER requires the adoption of a set of accompanying OE practices. Introducing transparency, reusability and participatory collaboration which accompany OE initiatives requires a significant shift in thinking in education design, involving a rethinking of the various elements of education and the roles they play. Introducing OERs into the curriculum design process cannot be done as an 'add-on' feature of education design; it needs to be conceived of as an integral part of the design process. Consideration of fundamental issues such as what form educational resources can take, what role they play in the education process will lead to a reconceptualisation of traditional models of education and it is in that context that the principles of open education can be addressed.

The other significant limitation of this study was the impact of the introduction of enquiry-based learning (EBL) pedagogical model adopted for the CFYC subjects on the curriculum design teams. The incorporation of a new pedagogy into the curriculum design process appeared to have a high impact on the workloads of academic teaching staff involved in the curriculum design. The EBL model was also perceived to have a potentially high impact on teaching workloads in the delivery of the subjects. This perception proved to be a great barrier to the introduction of the concept of OER to the curriculum design teams. In the context of this EBL-based curriculum design, OER were seen to represent additional pressure on teaching workloads, even though one aspect of EBL pedagogy is that students are normally required to locate their own educational resources. The conclusion drawn is that the introduction of the OER concept in the context of EBL curriculum design was felt to be one innovation too many at a challenging time for academic staff.
A greater integration of the OER project with the CFYC design process – including the tender process for publisher-supplied materials – would have helped in developing a unified approach to OER. Greater collaboration between different teams/functions within the faculty could have helped avoid conflicting actions. However, involving more parties in this project could have led to greater delays, as it normally takes longer to incorporate the views of all involved.

Conclusion and future work

It is not difficult to imagine a future for business students involving free and open access to educational resources from increasingly functional mobile devices. However the project described in this paper demonstrates that making this future a reality will require attention to a number of important issues. Firstly, awareness of the value of OERs, and the details of enabling frameworks such as Creative Commons licensing needs to be addressed with sensitivity to the work involved locating, assuring quality, and adapting resources that are appropriate and relevant. A collaborative approach to undertaking these processes requires the active participation of teaching academics as subject matter experts. Further, support in a systemic sense from the institution is also desirable and quite possibly necessary for successful adoption of an OE approach. A significant barrier was the adoption of a publisher agreement which stymied the incorporation of OERs into the development of the particular subjects targeted by this project. External barriers to adoption have also been noted here, including the fragmentation of OER repositories, the lack of true openness in licensing, and the sustainability of repositories in the longer term.

Despite this, the OpenTab project is continuing to have an impact in the development of new subjects and the redesign of existing ones. Since the conclusion of the first stage of the project, lecturers from other areas have contacted the project group to seek advice on incorporating OERs into their subjects. A new series of Blended Learning Flagship Projects in the Faculty will adopt OE as a principle, and the work of the project will go on through these projects. Finally, the Faculty has adopted an ongoing strategic project as part of its eLearning Strategy that will continue to foster an OE approach across all programs.

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Technology, identity and the creative artist

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Most tertiary students dream about their futures at some time during their studies, and the creation of a portfolio can play an important role in the formation of future identity. In today's culture, technology is rapidly expanding and changing and our society is becoming progressively more networked, digitilised and globalised. Teaching and learning processes are affected by technological developments. and the portfolio has been modified to utilise this technology (Penny & Kinslow, 2006). The process of developing electronic portfolios promoted a technology-enriched environment for creative arts students to cultivate their learning and knowledge. This paper reports from an OLT (formerly ALTC) funded project at its mid-way point. The project is introducing ePortfolios to students through existing curriculum in the creative and performing arts at four universities in Australia. The project forms part of continuing work to research practices in technology supported teaching and learning.

Keywords: ePortfolios, identity, creative arts, graduate employment

Introduction

Given the strong impact that ePortfolios have had on the higher education sector in areas of teaching and learning (e.g. previous ALTC grants at Queensland University of Technology and Curtin University), this project aims to enhance development of strategies for tertiary creative and performing artists to document skills acquired, and outcomes achieved, as beginning artists. Our project involves 186 students in four institutions (Curtin University; Queensland Conservatorium of Music, Griffith University; Sydney Conservatorium of Music, University of Sydney; University of Western Sydney), and includes a range of types, formats, uses and expectations of ePortfolios.

The creative artist's needs

Graduates from the creative arts transition to a complex work environment featuring multiple concurrent roles and a continuous cycle of work and learning. As individual students in creative and performing arts have different needs and expectations of their future, an ePortfolio is a way to assist students to reflect on their present and dream about their future. This paper is reporting on data gathered from four institutions that are using ePortfolios with creative arts students. Each institution in the OLT project is approaching ePortfolios, their introduction, contents and applications from its own perspective. One of the project's outcomes is to provide tertiary students from the performing and creative arts with skills to create an ePortfolio to document their academic and artistic outcomes for future enhanced employability in the arts sector. Imagining the future though understanding their present is one of the key outcomes reported so far in the students' creation of their portfolios.

Technology

A portfolio is a compilation of examples that present an individual's learning journey over time, demonstrating accumulated knowledge, abilities and personal qualities or traits (Butler, 2006; Sherry & Bartlett, 2005). ePortfolios are a tool that can inspire new and creative ways of thinking about the use of computers in education. ePortfolios offer learners the opportunity to trace their development and improvement over a period of time, and also to reflect on the processes of learning (Dunbar-Hall, Rowley, Webb & Bell, 2010). Their various advantages include accessibility, storage, ease of sharing, availability of upgrading, the ability to link various forms of digital media, options for presenting work examples, flexibility in selection of content dissemination, and collating and organisational potential (Sherry & Bartlett, 2005; Akcil & Arap, 2009).

In general, Batson (2002, p.1) notes that 'electronic portfolios have a greater potential to alter higher education at its very core than any other technology application we've known thus far.' There is evidence to suggest that there is an increasing emphasis on reflective learning and practice in higher education, and for some authors the nature of ePortfolios both encourages and supports this style of learning (Pelliccione & Dixon, 2008).

Identity

During their higher education studies, most students begin to think about their future work and lives. Creative arts students often define their future as being 'professional' (e.g. as a musician, artist, actor, writer etc.). By highlighting aspects of artistic identity versus professional career identity, the study reported here aims to generate new insights regarding the training of artists and the role that the portfolio can play in this identity development. This distinction is evidenced in the voices of the two students who feature in this short paper. A key component to the introduction of ePortfolios to the students in the various institutions has been the emphasis on authenticity and reflection. Rowley (2011) suggests that constructing an ePortfolio can be an effective method of developing these reflective skills. The students discuss how reflective practice involves not only thinking about isolated events but encompasses many aspects of their life, including musical background, attitudes, strengths weaknesses and philosophies.

The majority of research and literature concerning identity representation and development focuses on the concept of individual choice. Electronic portfolios tell a story about an individual and their learning, growth and development over time. A "self-constructed identity" (McAlpine, 2005, p.382) is portrayed through an ePortfolio. Therefore, identity development and representation is often considered in the discussion of ePortfolio research. An ePortfolio can be used to construct and present a particular identity for a certain purpose, and from a broad perspective, ePortfolios have been described as a means through which an individual has sophisticated control and manipulation of one's "virtual identity". Research also suggests that successful ePortfolios that encourage interaction through feedback have the capability to "support identity formation as well as representation" (Hartnell-Young in Jafari & Kaufman, 2006, p.129).

The concept of identity has also been described as the "learners' authentic voices" (Barrett, 2007). Barrett explains that through the process of developing and creating their own ePortfolios, learners' unique "voices" become evident. The capacity of incorporating multimedia components to the ePortfolio presents a new dimension to the definition of "voice" (Barrett, 2007). However, the inflexible structure of some ePortfolio systems does not accommodate individuality or personality. Barrett (2007) asserts that in order for an ePortfolio to be successful and engaging it is essential to allow flexibility so that learners are able to "express their own voice and leave their own mark in their portfolios" (p.4).

McAlpine (2005) also supports maintaining a flexible portfolio structure to allow for "multiple identities", various presentations and permit students with opportunities to tailor their portfolios for certain needs. McAlpine (2005) also explores the concept of ePortfolio identity with reference to authentication, discussing ePortfolios in terms of "story" and "assessment". McAlpine (2005) mentions the difficulties associated with authenticating electronic data, "checking that the data which is being presented does indeed associate itself with the real-word entity that it says it does" (p.381) and describes this issue of authenticity as contributing to difficulties with ePortfolio assessment.

Research supports the evidence of the importance of music in the formation of personal and social identity. This would be particularly relevant for the identity formation of musicians and aspiring music teachers, as music forms such an integral part of their lives.

> …music can be used increasingly as a means by which we formulate and express our individual identities. We use it not only to regulate our own everyday moods and behaviours, but also to present ourselves to others in the way we prefer. Our musical tastes and preferences can form an important statement of our values and attitudes, and composers and performers use their music to express their own distinctive views of the world (Macdonald, Hargreaves & Miell, 2002, p. 1).

The above quote mentions aspects contributing to an individual's identity such as musical preferences, attitudes and worldviews. Electronic portfolios offer a medium through which to present the many different facets that contribute to an individual creative artist's identity. The capabilities of an ePortfolio allow users to be creative in their presentation: to include real insights into whom they are as individuals, writers, teachers, musicians etc., or to highlight certain characteristics, skills, talents or abilities. A creative artist can therefore use this electronic medium to present each aspect of identity with more depth and profundity than can be achieved via other means.

Two students' voices

The project to date has worked with 186 creative arts students and has collected a range of data that demonstrate the development of students' identity through the interplay with the technology. The excerpts that follow come from the portfolios of two students after their internship program at a range of creative and performing arts professional practice placements.

We start with an extract from Andrew's portfolio following his experience at a classical music station:

> One of the earliest and simplest reinforcements of an idea central, I believe, to any career related to music comes back to the triangular relationship between composer (in which I was, up to this point, chiefly interested in and connected to) performer and audience. While I appreciated the role of performer and audience, I don't feel I ever comprehended the necessity of spending some time as each of these parties like I do now as a result of the tasks undertaken at the radio station. As a programmer, presenter and listener, I believe these experiences were synonymous with composing, performing and participating as an audience member. Where the composing is programming and selecting the program and presenting is performing, the most important member of the triangle really seems to me now to be the audience

Andrew had for some time thought of himself though different lenses. After this professional practice experience his identity began to emerge, as he grew closer to the end of his degree program. The creation of a portfolio for Andrew allowed him to justify why he felt ownership of multiple identities and to be confident enough to write these in a reflective way.

The second student, Sally, stated that the development of the portfolio at the conclusion of her semester gave her the confidence and knowledge required to approach the industry and gain employment. It also led to a better understanding of how to apply her musical knowledge outside of the learning environment and into the workplace. Sally felt that the development of the portfolio

> has been extremely significant and helpful in my journey as a musician. It has helped me realise and become more interested and passionate in becoming an orchestral musician in the future, as I needed to document and find evidence for the various performances I undertook during the semester.

The voices presented here illustrate that the different identities students emerge with as a result of the portfolio task can enable them to reflect on their present and imagine themselves into the future.

The future meets the present

With a focus on the ePortfolio and identity, the two students were part of a cohort of 186 students. Observations across the student participants strongly suggest that they have become more aware of their professional selves as they have developed their professional portfolios. Moreover, students have used this awareness to evaluate their own thinking in relation to their progression, goals and achievements.

Exploring real world experiences through the ePortfolio allows creative arts students to engage with technology in a way that strengthens their own identity. Exploring identity provides students with options, opportunities and a space to continue their own learning in a reflective way. A dream can be a reflection and the portfolio is a powerful reflective tool, particularly given that the real world of professional practice is often a long way from the work in which creative arts students will engage once they have graduated (Bennett, 2012).

Alongside any advantages attributed to ePortfolios in the development of student identity is the level of technological skills required for their creation. Students' technological learning has been enhanced through the production of their portfolios across a number of different platforms. Crucially, the individual nature of the ePortfolio has enabled each student to tell his or her own story, and to renegotiate their identity and the personas they present through their portfolio. This level of independent learning, reflection and investigation has encouraged in students an understanding and appreciation of the powerful role that technology can play in their future.

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Evaluating an institutional blended & mobile learning strategy

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The University of Western Sydney is investing in three levels of learning technology provision: institutional, academic-led and student-led. A new strategy launched in 2012 included infrastructure and software upgrades, recruitment of more staff to assist in blended curriculum design within disciplines and, from 2013, the issue of iPads to all new undergraduate students and to teaching staff. This paper describes how these initiatives are being evaluated, to gather evidence of the initial impact of the investment on the student learning experience and on the capacity of staff to provide quality teaching and curricula.

Keywords: blended learning, mobile learning, institutional strategy, evaluation

Context

The strategic vision of the University of Western Sydney (UWS) is ‘bringing knowledge to life’ among the growing and diverse population in Greater Western Sydney, across six campuses. In practice this means a focus on providing access pathways, support for learning skills development, and designing curricula that integrate learning with the life of the local community. UWS draws almost a quarter of its students from low socioeconomic status (SES) backgrounds. Many UWS students are time-poor. They often have work and/or family commitments, and may need to travel some way to reach a campus. So an effective and flexible blend of campus and online learning is essential.

The UWS definition of blended learning refers to “… a strategic and systematic approach to combining times and modes of learning, integrating the best aspects of face-to-face and online interactions for each discipline…”. Figure 1 shows schematically the key components of the University systems involved (dotted boundaries): campuses and within them teachers and students, in class or using online tools. The brown arrows indicate where these technologies can support learning interactions, internally and with the wider community.

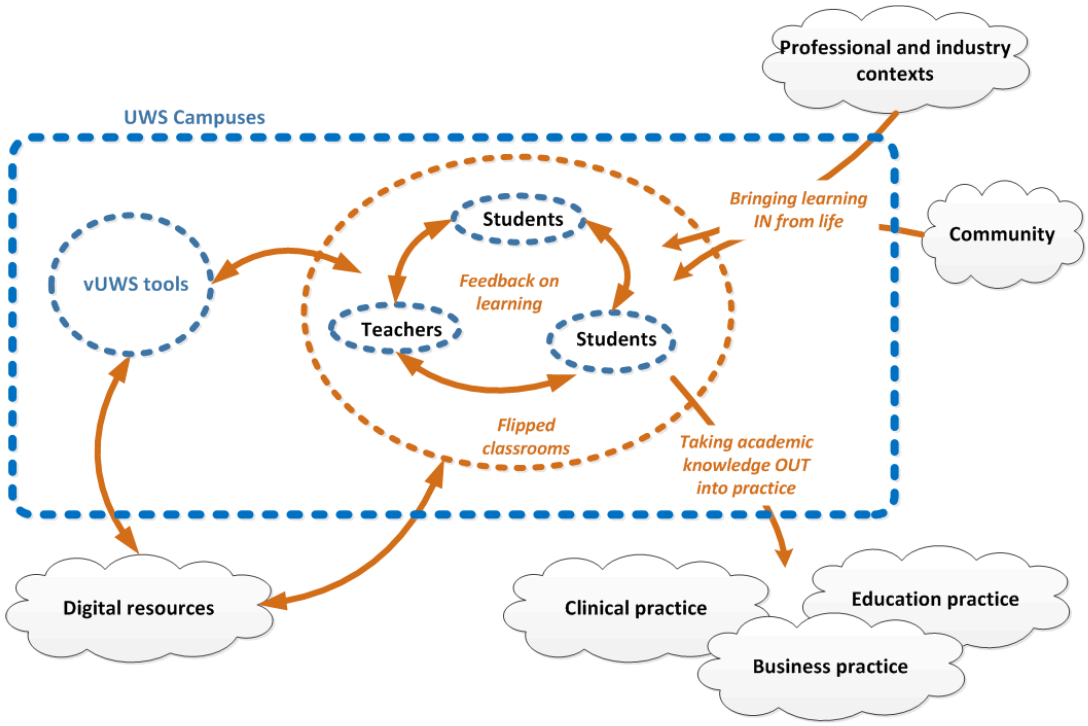

Figure 1 Where technology can help in 'bringing knowledge to life' in the curriculum

As well as an institutional online learning management system and extensive wifi provision on its campuses, UWS has also provided students and staff with iPad tablet devices. At the same time there has been a substantial investment in additional support for blended learning design within academic disciplines. Teams of blended learning designers and advisors based in Schools complement the work of a central team – a total of about 50 blended learning specialist staff working alongside curriculum development and learning skills support staff. The three objectives of the UWS Learning and Teaching Plan 2012-2014 are:
Students –optimize student access, engagement and success
Curriculum – implement a curriculum characterized by innovation, engagement and excellence
Quality – build staff capacity to engage in quality teaching.

Building on previous research

A large-scale survey of students across three Sydney Universities in 2010 provided information on student expectations and experiences of learning technologies. Analysis of the results (Gosper, Malfroy, & McKenzie, 2013) led to identification of three aspects of university technology provision:

4. institution-led (wifi, IT infrastructure & support, online learning management systems, provision of computers and tablets, etc.)
5. academic-led (how teachers are using the available tools to support learning activities)
6. student-led (how students are choosing to use their own technologies, such as their personal mobile phones and laptops, for educational activities).

A follow-up qualitative analysis identified where institution-led and academic-led initiatives have begun to address some of the student expectations (Russell, Malfroy, Gosper, & McKenzie, in press). In 2010 students reported inconsistent quality in their teachers' use of technologies for learning. Many students also asked for better wifi and support for use of mobile technologies on campus.

The advent of tablet technology such as iPads has further focused attention on mobile technologies in learning and teaching. However, the iPad was only released in 2010 and so research on its educational use is still in its early stages. Murphy (2011) describes six main capabilities of tablets in the university setting: ubiquitous access to course and subject materials; enrolment and administration; peer-to-peer and peer-to-education collaboration; content generation; research/material yielding; productivity enhancement.

The current initiatives at UWS, including the provision of iPads in 2013, are aiming to address simultaneously all three aspects of learning technology provision. For example, the iPad roll-out required enhancements to institutional infrastructure and IT support services and also to teaching staff development. Issuing iPads to students gives them more options for personal technology use. As part of the evaluation of these initiatives we are looking for evidence of how the students' reported experiences have changed since 2010. Figure 2 illustrates how the evaluation feeds into the core learning and teaching objectives.

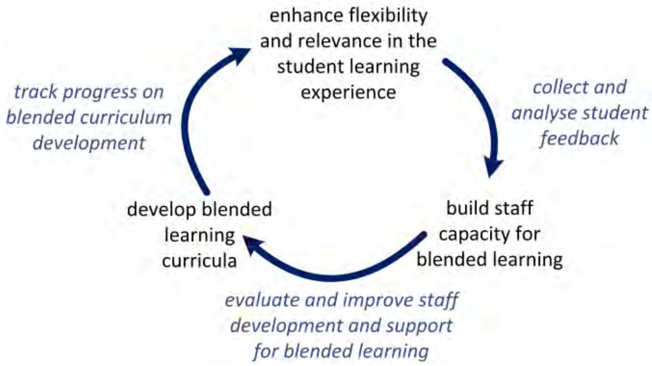

Figure 2. Three components of UWS blended learning evaluation: student, staff and curriculum.

The full benefits of the strategy may not flow through to curriculum design until 2014-5. But the provision of iPad tablet devices along with improved institution-wide learning technology systems in themselves will enhance students' ability to access learning resources and activities. Many teachers are also already introducing new ways of interacting with 1st year students, making use of mobile learning technologies.

Research methodology and methods

Overall this is a pragmatic evaluation exercise designed to provide evidence of how the introduction of blended learning design and mobile learning technologies is influencing student learning experiences and outcomes. Some specific research questions related to initiatives begun in 2012 are:

1. How has the 1st year student experience of technologies in learning at UWS changed since 2010?
2. How is the availability of iPad devices now influencing 1st year students' learning experience at UWS?
3. To what extent is blended learning already contributing to student learning experiences and outcomes?
4. How well are academic staff able to use online and mobile technologies to good effect in their teaching?

The research will adopt a mix of quantitative and qualitative methods, broadly following the triangulation design described in *Designing and conducting mixed methods research* (Creswell & Plano-Clark, 2011, p 63). In this design, qualitative and quantitative data are gathered together, initially analysed separately and then interpreted in combination, to provide explanations of how the institution-led and academic-led technology provision is influencing student experiences and outcomes.

The student experience

The primary data for gauging all aspects of the impact on student experience will come from anonymous survey of 1st year undergraduate students in September of 2013. This will use a subset of the 2010 survey questions, and then compare the results with corresponding 2010 responses. The survey includes two open-ended questions, identical to those used in 2010, which can be run through an automated thematic analysis developed for the 2010 data analysis (Russell, et al., in press)

To add more contextual depth to the institution-wide data, we are running discipline-specific focus groups with 1st year students. We may also be able to use BlackBoard learning analytics data to compare the reported tool use with system-generated data on use of tools in 1st year undergraduate study.

The staff experience

There will be individual interviews with a cross-section of teaching staff who are teaching 1st year students in 2013, and/or preparing to teach 2nd year students in 2014. The interview questions mainly focus on research question 4, and will aim to tease out whether the various support resources now available for blended learning are reaching their targets, and if additional staff support is required. Figure 3 shows a flowchart of how the various components of the research data and analysis will fit together.

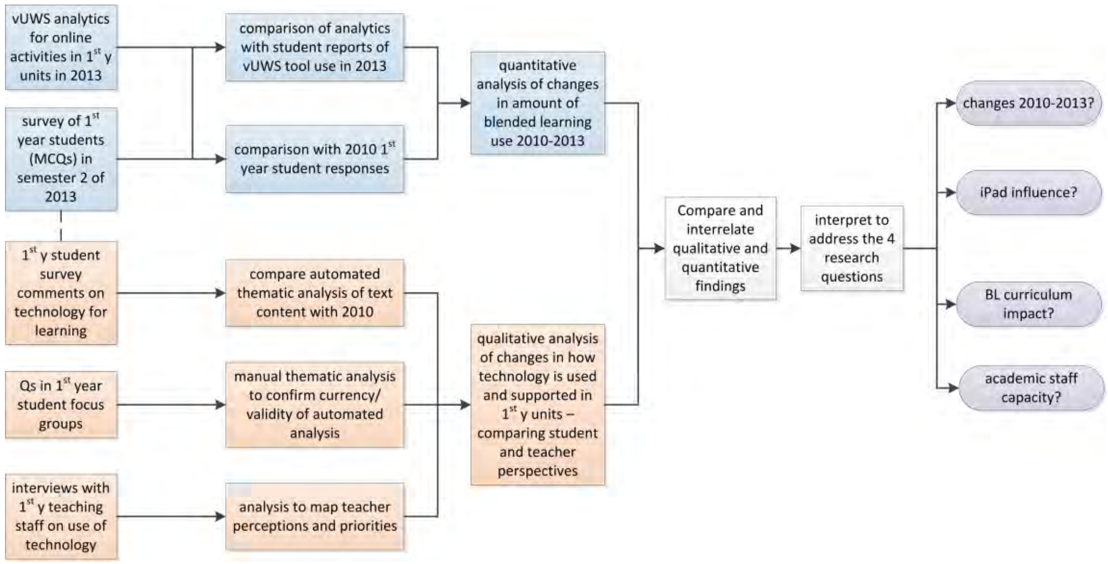

Figure 3. Summary of mixed method research process

Preliminary results and discussion

The 2010 survey asked students how frequently they used various online tools as part of their course requirements. Figure 4 shows an example of responses from 1st year UWS students on how often they used, and how often they would like to use, particular web-based resources.

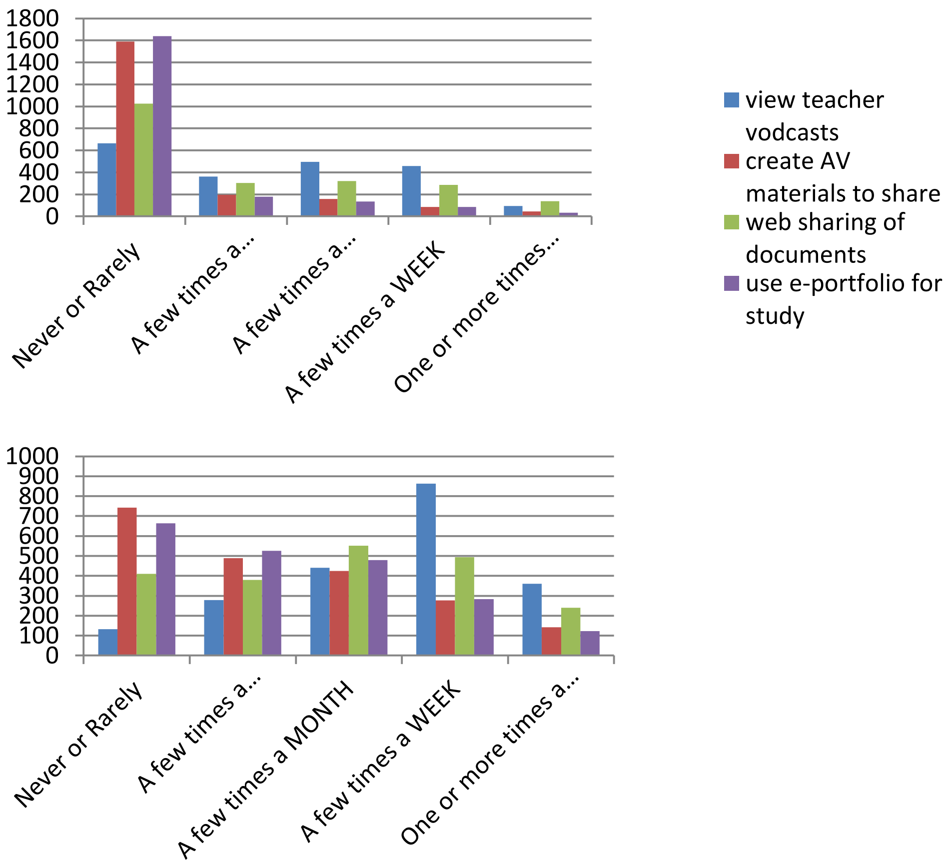

Figure 4. 1st year UWS students' responses in 2010 on how often they use web resources (above) and how often they would like to (below)

A word frequency query in NVIVO across the 2074 responses from UWS 1st year students to 'describe the most important ways that technology has assisted your learning at University' resulted in: **access, information, online** and **vUWS** (the UWS online learning management system) as the most frequent words.

A similar query run on the responses to ‘describe ways in which the University could use technology to better support your learning’ resulted in: **more, wireless, computers** and **internet** as the most frequent words. Thematic analysis of the text responses to these two questions showed a significant proportion of comments indicating that some teachers were not using the technologies as effectively as others (Russell, et al., in press).

A similar analysis of the corresponding 2013 data on use of web resources and tools will be available in early November 2013. So the conference presentation will include a report on the patterns of online learning activity in 2013, compared with 2010 student expectations. Preliminary data from staff interviews will also be available to identify priorities for continuing staff and curriculum development. Longer-term, the evaluation will provide a comprehensive tracking and adjustment of the institutional strategy for blended and mobile learning as it unfolds.

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Using technology to enable flipped classrooms whilst sustaining sound pedagogy

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This paper initially provides an understanding of what constitutes a flipped classroom model. It then provides a series of four case studies that describe the application of some different flipped classroom approaches to university courses, largely mediated by the use of online learning technologies. It demonstrates that these flipped classrooms are informed by constructivist pedagogy and highlights the role university teachers can play in facilitating their students' engagement with learning. It also highlights that to be successful in this transition to a new mode of learning requires both a holistic institutional planning approach, one based within a coherent student learning journey model, and sustained development by a team of centralised support staff, including technology experts, librarians and learning designers. The paper concludes with a discussion of the implications associated with adopting a flipped classroom approach.

Keywords: Flipped classrooms, technology, changing practice, Student learning journey

Introduction

This paper provides an analysis of four case studies that clearly demonstrate the affordance of technology in enabling a coherent model for the sustained use of flipped classrooms in a largely blended delivery model of university level courses and programs. It does this by first providing a description of the flipped classroom methodology and then demonstrates how flipped classrooms can introduce a parity of learning experiences for both on- and off-campus students, in a manner that blurs the distinction between these different modes of learning. Clearly framed within a constructivist pedagogy, this paper details with the application of learning technologies and the role university teachers can play in facilitating their students' engagement with learning.

Each case study describes, from a different perspective, the change leadership processes required to lead an institution from a delivery model based on traditional lectures and tutorials to a flipped classroom model and a transformed approach to student engagement. It demonstrates the importance of adequately preparing both teachers and students for participating in flipped classrooms. It also highlights that to be successful in this transition to a new mode of learning requires both, holistic institutional planning based within a coherent student learning journey model and sustained development of resources by a team of centralised support staff, including technology experts, librarians and learning designers. However, all this would potentially fail if not supported by a solid infrastructure of learning technologies that can be used to facilitate active and interactive learning in the online space. The conclusion drawn by this paper is that the flipped classroom is a useful summary concept that can facilitate real change.

Setting the stage

The flipped classroom approach has become an increasing popular approach for the re-visioning of student learning opportunities in universities, particularly since the widespread adoption of online learning environments has made it much easier for students to access information online and study independently of the traditional classroom. The flipped classroom approach is described in this paper through a series of four case studies, developed from current practice at the University of Southern Queensland (USQ) in Australia. This institution has specialised for many years in widening access to tertiary education through flexible, technology-enabled learning opportunities for all its students. With some 73% of it 27,000+ students studying off-campus and online, USQ has centralised much of it practice around the use of its Moodle learning management system (LMS), which is further supported by a suite of online tools such as, virtual classrooms, ePortfolios and multiplatform online media presentation systems.

The university also places a very strong emphasis on its student support systems, designed to foster a coherent approach to the student learning journey (Hunt & Peach, 2009). In broad terms there is a focus on the key categories of the USQ student learning context including, domestic students studying either in an on- or off-campus, or online mode, international students studying in Australia, or in their home countries, again studying in one of the three modes. For each of these groups planning focuses on ten key interaction points of the student learning journey (see Figure 1 below) from decision to enrol, through the first year learning experience, which is crucial to student retention and progression, and on to work-ready graduation, or preparation for further study (Sankey 2012), and all facilitated in the online space.

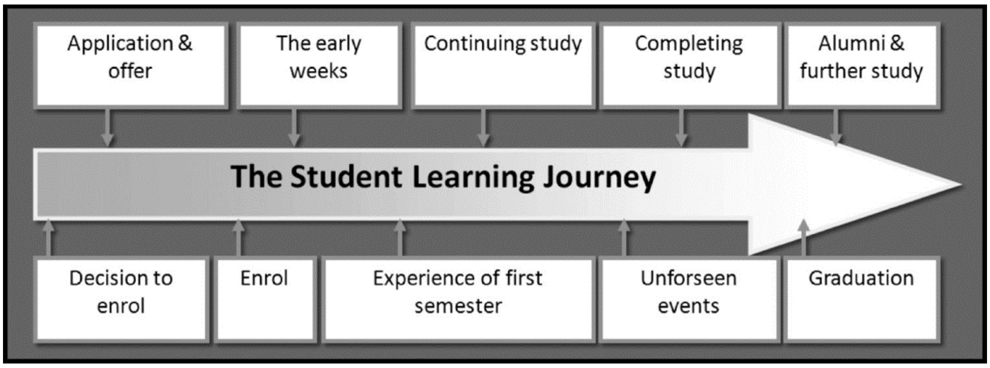

Figure 1. Key stages of the student learning journey (Hunt & Sankey 2013, p. 263)

Given USQs intense focus on off-campus and now online education that has been sustained for over three decades, it has been necessary not just to keep pace with developments in learning technologies, but to look for innovative ways in which to work in this online space. Its investment in learning technology infrastructure and methodology was described in generational terms by Taylor (2006) some seven years ago, and still rings true today. The first generation Taylor describes was the print based correspondence model, followed by the multi-media model that incorporated audio and videotape and computer-based learning. The third generation model, 'telelearning', adopted audio-teleconferencing and videoconferencing, while the fourth generation, flexible learning, engaged students with online interactive multimedia and internet-based access to resources. Taylor's final generation model is based on 'intelligent flexible learning'. Add to this mix computer mediated communication, using automated response systems and campus portal access to institutional processes and resources, and you have a pretty good picture of where USQ currently places itself within the higher education marketplace. All this to say that USQ has consciously planned an infrastructure of learning technologies designed to get the context right to support student learning. This is important because as Scott (2005) indicates, to learn effectively, students want, 'efficient and responsive administrative, IT, library and student support systems actively working together to support … operation[s]' (p. 13). For USQ, this is what underlies the ability to fully embrace a flipped classroom approach.

Flipped classrooms

The learning technology infrastructure and the planning processes at this university set the stage for this series of case studies based on USQs adoption of flipped classrooms. The term 'flipped' refers to the provision of tailored online resources and learning activities that facilitate student preparation for classroom study time which is then focused on application and consolidation. 'Essentially, what was traditionally completed at home as homework has been flipped to become the focus of classroom learning' (The Queensland Government 2012). Or as Pink (2012) puts it 'Lectures at night, "homework" during the day' (p.38). In simple terms, flipped university classrooms represent a move away from standard lectures and tutorials and a move towards scaffolded learning experiences based on a series of activities and workshops, or by mediated online discussion. It makes sense, as Boyer (2013) noted, because 'It does seem ironic that so much time is spent in class 'teaching', and then students are sent home to struggle through the actual 'real work' on their own without any assistance'. However, this characterisation of 'home' work, or private study, as 'application' and 'consolidation' represents only half the story, because in universities, with or without learning technologies, private study has also been used as preparation for interactive discussion and analysis in class. However, the important feature of flipped classrooms is not that they are new, or that they represent a move away from traditional lectures, or even that they use technologies. Rather, the issue is that flipped classroom approaches combine pedagogy and learning technologies in ways that extend to large numbers of student's opportunities for deep learning through application and consolidation.

The flipped classroom is a form of curriculum design that shifts students from passive to active learning. It is designed to foster deep learning, which Angelo (2012, p. 99) defines as, 'learning that lasts and can be recalled and used effectively after the… [course] has been completed'. Flipping classrooms has been described as: 'providing students with a video that explains the concepts, structure and skills, so that when they get to class… they can get into a real 'workshop' of learning. In this way, the teacher is on hand to give practical assistance, check progress and pick up common errors' (Boyer, 2013, p. 28). Educause (2012, p. 1) also refers to the use of videos in flipped classrooms:

> Short video lectures are viewed by students at home before the class session, while in-class time is devoted to exercises, projects, or discussions. The video lecture is often seen as the key ingredient in the flipped approach, such lectures being either created by the instructor and posted online or selected from an online repository. While a pre-recorded lecture could certainly be a podcast or other audio format, the ease with which video can be accessed and viewed today has made it so ubiquitous that the flipped model has come to be identified with it.

However, the identification, or association of flipped classroom technology with video use is somewhat simplistic. It is also limiting pedagogically because there is a risk that the videos remain a didactic presentation of content because, 'You can't magically transform an ineffective lecture by transferring it to video' (ISTE 2012, p. 10). 'Dumping content' online via video or text is not much of a change from traditional university lectures. However, one analysis (ISTE 2012, p. 10) indicated that 'A glimpse of the videos shows … that these teachers are taking full advantage of the medium to create instruction that goes far beyond chalk and a blackboard'. In this context, the importance of the university case studies, described in this paper, is that the use of learning resources is varied beyond videos, as the teaching strategies are interactive and their resources extend to use of open source material. Further, the case studies demonstrate how learning management systems are used to provide opportunities for discussion and debate, both online and in class, in a melange that blurs the so called distinctions between 'home' work and classroom learning. They also show how off-campus students can benefit from the same levels of so-called classroom interaction as on-campus students. What the case studies demonstrate is that anytime-anywhere learning using a flipped classroom approach can facilitate equal learning opportunities for on-campus and off-campus students.

According to Educause (2012, p.1) 'The flipped classroom is a pedagogical model in which the typical lecture and homework elements of a course are reversed'. This definition of the flipped classroom, as pedagogy, accords with Hattie's (2009) thoughts about the need to 'Attend first and foremost to the fundamentals of effective teaching and learning, keeping pedagogy ahead of technology'. Reeves and Reeves (2012, p.114) summarised Hattie's (2009) meta-analysis of 'the foundational building blocks of any robust learning environment, be it a face-to-face, a completely online or a blended model'. Given that the results refer to any learning environment, they are applied here to flipped classrooms. The results show that effective learning is facilitated by:

- teacher clarity in explaining content;
- high academic challenge;
- time-on-task;
- timely feedback to students; and
- positive teacher–student relationships.

Among the least effective elements of teaching were:

- computer-assisted instruction;
- simulations and games;

- audiovisual methods;
- programmed instruction; and
- web-based learning.

It would appear that, when it comes to student learning, it's not what you've got, but the way that you use it (pedagogy) that counts. Accordingly, the case studies in this paper illuminate the effective use of technology and their integration with appropriate pedagogy and varied learning activities conducted in a manner that enhances student learning outcomes.

So what are the elements of pedagogy that have been identified with flipped classrooms? They normally include active learning and student engagement, both of which fall into the broad category of constructivist learning theory, which, according to Stewart (2012, p. 11): 'Emphasise[s] student-centred, active learning and the role of the teacher as facilitator. They include:

- an emphasis on students being active in constructing their understanding of knowledge;
- a focus on discovery, exploration, experimentation and developing and testing hypotheses;
- project work, research-based learning, problem- and enquiry-based learning methods (see Brodie 2012; Jenkins & Healey 2012);
- awareness of the learning process through use of reflective learning activities, self assessment and evaluation;
- the role of the teacher as a guide, providing 'scaffolding' to learning – that is, to ensure the student has the requisite knowledge, skills and support to negotiate a new piece of learning – and prompting the student through questioning or modelling.'

One final element in setting the stage for discussion of these case studies of flipped university classrooms concerns the role of the teacher, or lecturer. Goodwin and Miller (2013, pp. 78-79) noted that:

> Advocates of the flipped classroom claim that this practice promotes better student–teacher interaction. For example, Bergmann and Sams (2012) point out that when teachers aren't standing in front of the classroom talking at students, they can circulate and talk with students. If teachers use inverted classrooms this way, they are likely to better understand and respond to students' emotional and learning needs

In flipped classrooms, teachers become coaches, focusing more on facilitation than lecturing. This changed role was described by Hunt, Chalmers a Macdonald (2012, p. 27) as a shift from being a sage on the stage to a guide on the side, but, more importantly, to being a meddler in the middle:

> The shift in focus from didactic teaching, sometimes described as the 'sage on the stage' model to the 'guide on the side' model, has been challenged by McWilliam (2008) who argues that teachers should be 'meddlers in the middle'. These are teachers who challenge students to think and understand differently. To do this, university teachers need a repertoire of activities that will engage students actively in learning. Scott (2005) found in his study of nearly 95, 000 graduates that students appreciate a range of interactive classroom learning strategies such as buzz groups, debates, lectures and small group work for peer learning, independent study and negotiated learning.

The role of meddler and the variety of teaching strategies described here sits well with the flipped university classroom described in the case studies in this paper.

The four case studies described

The following four case studies of flipped university classrooms refer to three courses (or units/subjects/papers) of study and to the use of this methodology to progress flipping a whole degree program. These examples were chosen to represent different uses of the flipped classroom approach and to demonstrate how it has been integrated with students' needs at different points of their learning journey. For example, we discuss how Associate Professor Jill Lawrence uses the flipped classroom approach in an introductory nursing course on academic skills development, a course designed to prepare students for university study. Later in the learning journey, Steven Goh uses flipped classrooms to create authentic learning experiences that prepare students for professional life. The paper then discusses another model of flipped classrooms used by Eleanor Kiernan in a core communications course used across multiple programs. In the final example, Associate Professor Karen Noble outlines what has been happening in the Education Faculty, in an ongoing journey to flip a whole degree program as part of a faculty initiative to move all their courses online.

Case studies normally draw on ‘a number of data-gathering measures’ (Berg, 2001, p. 225). Accordingly, the data for these case studies arises from two sources, a series of one-on-one interviews and documentary evidence. The four recordings that serve as the basis of these case studies are available online (Kiernan and Sankey, 2013, Lawrence and Sankey, 2013; Goh and Sankey, 2013; Noble and Sankey, 2013) under a Creative Commons, attribution, non derivative license. The purpose of these four case studies is to share ‘well-documented experiences … not by blind adoption, but by critical adaptation’ (Wals, Walker and Blaze Corcoran, 2004, p. 347). The purpose is to also engage with the transformative agenda of integrating learning technologies with constructivist pedagogy to enhance student centred learning.

Academic skills development

In her account of flipped classroom methodology in a first year nursing course focused on developing academic skills (Lawrence & Sankey, 2013), Associate Professor Jill Lawrence notes that students are provided with little content in terms of readings and lectures. Learning is activity-driven (e-tivities) (see Figure 2) and she utilises open-source resources, such as TED (www.ted.com) and YouTube, because, as she puts it, “There are gurus and experts all over the world”. Jill therefore sees little point in reinventing the wheel by creating yet more resources. She makes available a series of short audio enhanced PowerPoint presentation each week to contextualise the forthcoming weeks work. The essence of each week’s study lies in one to three student-learning activities. Each activity starts with a ‘spark’ (idea), then a stated purpose, and then she provides a stimulus, such as a YouTube video, then a task for students to complete, which usually take the form of a 100 word reflection about the activity. Each activity is closely linked to assignments so that students who fail to engage with the continuous learning associated with activities might find it difficult to complete assignments. They will also have little on which to fallback, because learning outcomes are vested in the learning activities and not in lectures, videos and readings; though these do add some value to learning.

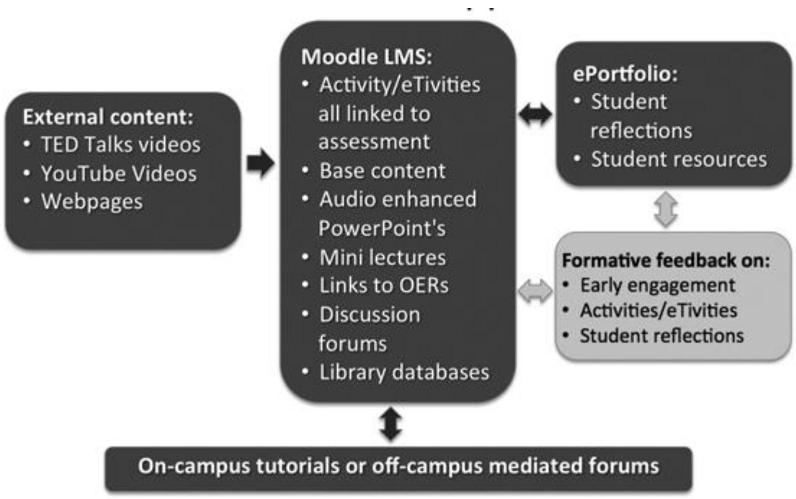

Figure 2. The flipped classroom model used by Lawrence

Early in the semester Jill has a learning activity that asks each student to interview a more experienced student to find out how they have successfully negotiated their university study. Students are also invited to respond to an electronic questionnaire about their learning style and to reflect on their own learning strengths and weaknesses. They are also asked to post on the discussion board, in the LMS, brief points arising from their activities. For example, after the first week of study they document their learning strengths and identify possible support people. Tutors working in the discussion groups provide early one-on-one feedback to students, and peer feedback is also invited. The outcomes of activities are discussed in class and in online discussion forums. Dr Lawrence reports that students, particularly mature-aged students, generally provide negative feedback about these online forums early in the semester, but most of them become more positive by the end of semester, once they have mastered the medium. She notes also a correlation between participation and success, and poses as her next challenge, innovations that will engage unwilling participants.

In her paper about empowering online pedagogy for commencing students Lawrence (2013, p.8) provides evidence of student feedback indicating that the combination of discussion forums and e-tivities increases student engagement:

> *"For me the forums have also been an excellent way to interact with fellow students through the sharing of opinions and feedback. It made me feel like I was learning collectively with other students, much like a classroom situation (portfolio reflection)."*

> *"The use of short e-tivities and YouTube clips … has provided a positive experience for me because of the variety, which tends to keep my attention (forum post)."*

Lawrence (2013) believes this flipped classroom approach has been largely successful over a five-year period, but she acknowledges that this it an iterative process involving constant change, and that 'for a minority of students online engagement remains problematic' (p.9). This leads her to conclude that there must be an opportunity for students to be 'tracked and confronted explicitly' (p.9) when they are not fully participating, noting that she has identified a direct correlation between the level of online student engagement and the attainment of successful outcomes for the students in this course (Lawrence and Sankey, 2013).

Authentic learning

Steven Goh was inspired to flip his Materials Technology course to address the low engagement of students and what he perceived to be surface rather than deep learning. He wanted a shift to authentic learning pedagogy: 'from engineering science to engineering practice' (Goh & Sankey, 2013). He also wanted students to learn how to source databases of information (something they must do in the world of work), rather than rely on traditional study guides and textbook material. So he decided to 'introduce an authentic learning activity based on a true life case study' (Goh, Cochrane & Brodie, 2012, p.2). He now uses open source material, such as YouTube and TV programs that describe cases of materials failure. For example, in airline crashes, or in bridge building failures. He creates links to the world of work by inviting crash investigators to share their knowledge, and then he takes students on site visits. Initially students didn't like the course declaring that the course coordinator was not doing enough teaching. This resulted in Steven providing more scaffolding for the activities and resources, making it explicit to his students that his aim is to help them to become professionals (see Figure 3). Goh (2013, p. 2) believes that, 'if students are immersed in a rich and authentic professional environment with real-time input from industry practitioners, they are more engaged with the learning experience as desired and designed for'.

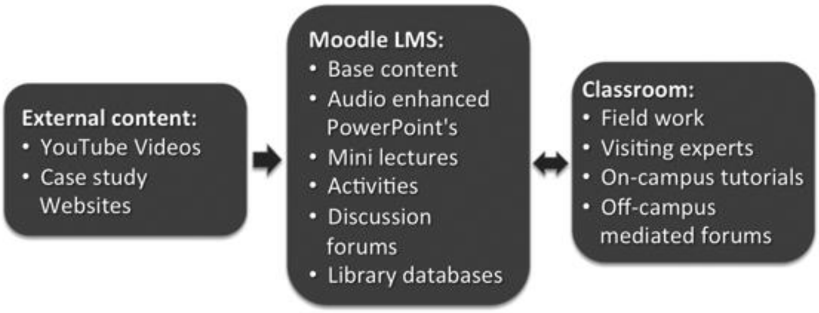

Figure 3. The flipped classroom model used by Goh

The flipped classroom approach in this Materials Technology course began in 2008 and, although early student feedback was negative, Steven pushed through, believing this to be a more authentic way to learn. This had been the first time something like this had been tried in his faculty and students were not used to it. They wanted traditional lectures and course materials. In response to this, Steven concentrated his efforts on preparing students for the new style of learning, noting that, "Students need somewhere to start". Essentially he set about managing students' expectations, not by giving them more reading materials, but by providing a series of short audio enhanced PowerPoint presentations in which he verbally deconstructs and contextualises his expectations (aspirations) for them. He does this by focusing their attention on the learning outcomes of the course and by establishing the relevance of the course to professional practice. Most importantly, he worked at establishing a credible relationship with his students though classroom and online discussion. Very quickly, he began to notice that traditional distinctions between on-campus and distance education (external) students began to blur. Oftentimes, on-campus students chose not to attend on-campus tutorials, electing instead to join-in with online discussions. On the other hand, Steven always made transparent when and where on-campus tutorials would happen and many so-called external students decided to travel in to engage with his on-campus students. As a result of relationship building and the management of expectations, student feedback became more positive, thereby vindicating Steven's perseverance with flipping the classroom to create scaffolded, blended learning opportunities for students of Materials Technology.

Helping first year student's transition to study

Communications and Scholarship (Com Schol) is a Core course offered by the Faculty of Arts and used by other faculties as their basic course to introduce first year students to fundamental communication principles and academic writing skills. In 2005 Com Schol moved away from its traditional face-to-face delivery model, based on a two hour lecture and a one our tutorial, to a flipped classroom approach that did away with the lecture and focused rather on providing coherent media-rich resources upfront, along with a two hour tutorial (or online discussions). Eleanor Kiernan (Keirnan & Sankey 2013) believes this model is particularly well suited to communication style subjects. In this course the materials are provided upfront in the form of a self-contained online study package, heavily supported by the LMS. The package is in the form of a navigatable website that contains textual information and is heavily augmented by a range of pre-recorded interviews with experts, audio enhanced PowerPoint's, audio recording, interactive multimedia, quizzes, exercises, animations and readings. Both on- and off-campus students are expected to engage with these material prior to either coming to the two hour tutorial, or by participating in a series of facilitated online discussion forums (see Figure 4).

While the two hour tutorial for on-campus students briefly goes over some of the key points in the course materials, it is made very clear that the tutorial does not contain all the information they are required to engage with during the course. Typically the key concepts within in any given week's work are discussed in class, or online, in a context that relates directly to the students lives (personalised). This is an extremely new concept for many students and as this is, in may cases, the first course a student will do when coming to USQ, there is significant scaffolding provided to all the information the students require to be successful in this course. For the first time (in 2013) since Com Schol was flipped (2005), off campus students where provided their own discussion space, separate to the on-campus students. This allowed the tutors to fully focus on this cohort and run a series of online activities designed to replicate some of the activities that would happen in the on-campus tutorials. Kiernan believes this strategy has 'worked really, really well' (Kiernan & Sankey 2013).

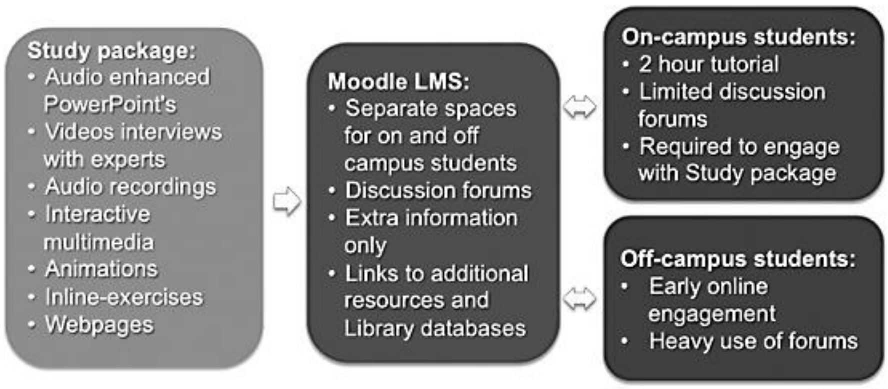

Figure 4. The flipped classroom model used by Kiernan

However, when asked to reflect on how this course has progressed over the years it was noted that 'Rome was not built in a day' and that it actually took a few years to build this course up to a point of its current sophistication. Having said that, this build-up has comes with a legacy; Kiernan believes there may now be to many resources and to many readings in the course, leading to some repetition of content. She believes that this could, inadvertently, lead to some confusion for the students, by them not knowing how to discriminate between all the resources.

Notwithstanding that, Kiernan also believes that putting in the effort upfront, in developing a coherent set of course materials, has paid dividends in the longer term. But she then warns against leaning on ones laurels, noting materials need to be checked on a regular basis. This is particularly true for the interactive and media based materials, those that are not text based – these need to be kept up-to-date. To help the materials stay somewhat current, Kiernan avoids information that may quickly date a presentation, such as mentioning dates and referring to current topical activities that may not be so topical in a year or so.

A flipped degree program

The Faculty of Education took an opportunity two years ago to begin the journey of flipping its 148 courses. Associate Professor Karen Noble and a number of key academics within the faculty have led this change and her story ‘Flipping a Faculty’ (Noble & Sankey, 2013) provides detail about change leadership processes that have proved successful in developing a flipped classroom model for the Faculty.

One motivation for flipping classrooms in the Education Faculty was to maximise the learning outcomes of students’ on-campus time. The faculty wanted something better for its students than traditional lectures and tutorials. There were also concerns about parity of experience between on-campus and external students. Traditionally this parity had been achieved (somewhat dubiously) by capturing on-campus lectures and making these available to off-campus students. However, the quality was poor and it is was seen as less than engaging for students to listen to one-hour lectures online. A decision was taken to design for online study “first and foremost”, creating a balance of synchronous and asynchronous learning opportunities for all students. Many courses are now largely process-driven by students’ by using learning activities. They still have online lectures, but these are purpose-made and broken into short and sharp presentations described as “less naïve and more sophisticated”. As this is an education faculty that trains teachers, it was deemed important to model good practice. Consequently many of the courses model critical reflection in a pattern of learning described as “deconstruct, confront, theorise and think otherwise”.

Karen notes the importance of “institutional support and tools” in flipping classrooms in the Education Faculty (see Figure 5). Specifically she refers to the importance of designing these courses with the ‘online first’ approach. To achieve this the Faculty required strong support provided by the Learning Innovation and Technology Enhancement (LITE) teams. These teams are made up of learning and teaching designers, technology experts, librarians, and multimedia developers. However, their help is stretched thinly across the many demands of faculty staff. To help avoid this, a community of practice (Macdonald et al. 2012) was established in the faculty through which early adopters and mentor colleagues could model/demonstrate specific techniques and strategies that have worked for them in their flipped classrooms. This has resulted in a move from dependence to independence in the ongoing maintenance of many courses. Part of the change leadership involved re-educating students to the new process-driven approach. But the faculty is now at the stage where many students have only ever experienced the flipped classroom methodology. In other words it is fast becoming business as usual.

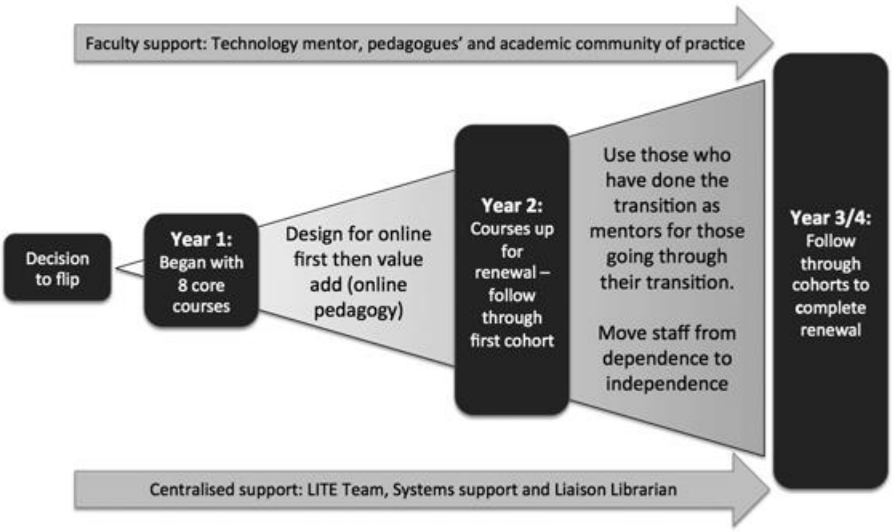

Figure 5. Change leadership strategy to develop program-wide flipped classrooms

Discussion

The four case studies described in this paper reveal common, successful elements in flipped university classrooms. Each demonstrates an effective integration of constructivist pedagogy while utilizing a range of learning technologies. All noted a shift from lecture driven courses to process-driven curriculum design, based on learning activities. This gave rise to a corresponding shift in the role of university teachers, as they now became facilitators that guide student learning. The application of flipped classroom methodology to on-campus, distance education and online courses is of particular interest in these case studies, because it shows how this approach can create a parity of learning experience and provide opportunities for 'anytime, anywhere' learning for all students. The case studies also demonstrated the application of flipped classroom methodology to generic skills, such as academic and communication skills and reflective practice, and to discipline-based courses, such as materials technology.

These case studies have demonstrated how the implementation of flipped classrooms at USQ was aided by a well established infrastructure of learning technologies. It also revealed the extent of change leadership and professional development required to prepare staff to manage both the technology and the pedagogy of flipped classrooms. This remains a continuing challenge for the university, which it is managing by just-in-time support from technology experts, librarians and instructional designers. As Anderson (2008, p. 68) noted, the task is 'to choose, adapt, and perfect, through feedback, assessment, and reflection, educational activities that maximise the affordances of the Web'. In addition, as the Education Faculty case study illustrated, each faculty has at its disposal staff willing to pull in the resources, collaborate and to make change happen at course level. The lesson is that flipped classroom approach is most successfully implemented in an organization that fully supports this approach to teaching and learning.

Interestingly, some of the case studies revealed considerable student resistance to the use of a flipped classroom methodology. This challenge was addressed by a range of strategies to increase what Anderson et al. (2001) call a cognitive and social presence in all learning environments. A key strategy was to organise students into online or on-campus discussion groups, with an instruction to tutors to respond quickly to students. This accords with Kift's (2009) transition pedagogy to enhance first year learning at universities. For example, she noted that first-year students should 'receive regular, formative evaluations of their work early in their program of study to aid their learning and to provide feedback …on progress and achievement'.

Student retention rates are a challenge for all universities, not only because students who dropout of university represent a loss of income, but also because it is a lost opportunity for each student who leaves. The first year of study is a particularly vulnerable time for students. To address this, Kift (2009) identified a transition pedagogy that included the recommendation that 'the first-year curriculum … have strategies embedded to monitor all students engagement in their learning …to identify and intervene with students at risk of not succeeding'. This series of case studies demonstrated that the affordances of a flipped classroom methodology, in particular the use of a learning management system and appropriately designed and scheduled learning activities, increased opportunities for staff to monitor students because their access to learning resources can be recorded: 'Use of the medium in this way will permit instructors to conduct assessments with greater granularity. Teachers can embed questions throughout materials to determine when and where students begin to struggle' (ISTE 2012 p11). This aligns with the literature on discipline-based learning and threshold concepts because teachers can monitor students' understandings of key concepts before moving on. According to Land (2012, p.42), a threshold concept:

> may be seen as a crossing of boundaries into new conceptual space where things formerly not within view are perceived, much like a portal opening up a new and previously inaccessible way of thinking about something. Successfully negotiating a threshold concept allows the learner to access a transformed way of thinking and practicing, a fresh mode of reasoning and explanation and new understandings, perceptions, discourses and conceptual terrain, without which the learner would find it difficult to progress within a particular field of study.

Another strategy to address student concerns about flipped classrooms was to manage students' expectations by focusing on learning outcomes and by establishing the relevance of the course to students' professional lives, particularly through authentic learning activities and assignments, the distinctive feature of which 'is the recognition of the potential of the activity, context and purposes of work to develop high-level knowledge and skills' (Garnett 2012, pp. 165-166). As Reeves and Reeves (2012, p. 117) observed, 'it is much more effective to engage students in tasks that reflect the ways their knowledge, skills, attitudes and intentions will be applied in the real world'.

Conclusion

In conclusion, these case studies have described the application of flipped classroom approaches to a series of university courses. The discussion of these case studies has also shown that these flipped classrooms are informed by constructivist pedagogy, which is part of a long tradition in higher education dating back more than a century:

> [It is a] philosophy of learning known as 'constructivism', essentially a theory that knowledge can be constructed only in the mind of the learner. This reflected much of Dewey's thinking and was … given a stronger foundation through Piaget's work. The onus was clearly shifting to the learner as the creator of understanding.' (Stewart, 2012, p. 7)

The case studies have also shown that at USQ the infrastructure of learning technologies deployed in flipped classrooms is part of a decades' old tradition of constant renewal occasioned by the university's focus on distance, and more recently, online education. This has positioned the university well for adopting a flipped classroom approach. Even so, the organisation has faced considerable challenges of change leadership in which the summary concept of 'flipped classroom' proved useful because it 'has encouraged dissemination … [and] because it is short and memorable' (ISTE 2012, p. 10).

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Understanding our present: teaching disputes resolution through online role-play

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The Disputes Resolution unit in the School of Law at Charles Darwin University demonstrates how new technologies can be used in higher education to design connected, innovative and interactive learning environments that stimulate the teaching of practical mediation skills. A pedagogic approach suited to online teaching is used in which online role-play scenarios are conducted using a variation of the online fishbowl approach. With this approach internal and external students take on character roles and interact in a synchronous online environment during a two-week intensive teaching block. The students jump in and out of their roles over the course of the two weeks as they research, role-play, interview and conduct peer reviews of the interactions. New technologies combined with innovative pedagogy enable the repositioning of external students as very much internal in the learning process and a new level of connection and interaction is possible between internal and external students.

Keywords: law, disputes resolution, online fishbowl, role-play, situated learning, learning technologies

Background

In this age characterised by the fast-paced churn of new technologies this paper presents a timely examination of the application of these technologies in higher education. The paper explores our dreams of connected, innovative and interactive learning experiences and environments in higher education in the School of Law at Charles Darwin University (CDU). While on one hand new technologies are supporting the realisation of these dreams, the efficacy and sustainability of new pedagogies and approaches to learning and teaching are challenged by the very technologies that have inspired their development.

CDU is a regional university located in the Northern Territory (NT) of Australia. The physical isolation and low population of 233,000 people in the NT have created the incentive for CDU to invest heavily in the online delivery of many of its units. In the School of Law 100% of units are online reliant, that is they are delivered online with internally and externally enrolled students engaging with online content and activities and interacting in the online space. Online teaching and learning is facilitated via CDU's Learning Management System.

The Disputes Resolution unit was redeveloped as an online unit for the start of 2011. At the time it was the only skills based unit in Dispute Resolution offered fully online by an Australian university. Most opted for face-to-face block components. The unit is highly practical and aims to provide students with the opportunity to develop the dispute resolution, negotiation and mediation skills required in the practice of law. The unit redevelopment presented a challenge with regard to how to develop practical skills in an online environment, particularly given that role-play scenarios were the principal means of developing these skills. In addition to developing the practical skills, a design solution was required that would also meet other desired outcomes of the unit, including the creation of a learning community integrating both the internal (on campus) and external (off campus) participants.

Theoretical basis for the innovation

The Disputes Resolution unit is underpinned by Lave and Wegner's (1991) theory of situated learning and subsequent refined versions of the theory (Herrington, Reeves & Oliver 2010; Korthagen 2010; Light 2006; McLoughlin & Luca 2006). Situated learning postulates that learning takes place in social contexts and over a period of time. Participation in learning activities is designed to increase levels of involvement, knowledge and competence commencing with legitimate peripheral participation in a community of practice, during which a cognitive apprenticeship is taking place. This leads ultimately to full participation in the community. Situated learning aligns with the concept of authentic learning in the online environment. Authentic e-learning involves immersion in realistic tasks that involve opportunities for collaboration in complex activities (Herrington, Reeves & Oliver 2010). Those that undertake the unit are actively participating in their skills acquisition and are called 'participants' rather than 'students' to reflect this.

The Disputes Resolution unit provides a context for the application of the practices of situated learning, authentic e-learning and the development of a community of practice. The participants in the unit enter an online learning environment where they become 'practitioners'. They assume roles and identities at the peripherals and as they learn they move towards the centre of the community. Interactions are modelled by the lecturer, invited guests and peers and the student practitioners learn from these and develop competence as they engage in role-play scenarios. By the time they have reached the centre of the community they will have mastered the discipline and will in turn be showing others.

The process of community building in the unit is structured around the three-stage community building paradigm in distance education identified by Brown (2001), whereby:

1. The participants make online acquaintances through interaction;
2. Community conferment and acceptance is gained through discussion with numerous class participants;
3. Camaraderie is developed based on long term or intense associations.

The emotional connectedness that is achieved through community building underpins student success in a particular unit of study and contributes to 'a positive lifelong affiliation with both the department and the degree-granting institution' (Brown 2001 p.19).

Design of the Disputes Resolution Unit

The Disputes Resolution unit is designed around a two week intensive block which participants attend in person or online. Activities that occur prior to the intensive block prepare students and provide the causal conditions for the development of an online community (Brown 2001). During the intensive block mediation skills are acquired through role-play within a supportive environment where cognitive apprenticeship takes place and expertise is developed. Follow up activities encourage reflection and consolidation of the learning.

An introductory lecture is held four weeks prior to the intensive block. This initial contact is synchronously held with all participants via the online classroom. This models the integration of both external and internal participants into the online space visually and orally. Between the introductory lecture and the intensive block the online classroom and video conferencing facilities are available for participates to meet, forge community alliances and practice.

Unit readings are made available with an expectation of completion prior to the intensive block. Access to the readings removes the stress and fatigue on participants of not being able to prepare and study during the teaching block and empowers them by being in possession of all the materials for all activities prior to them occurring (Ramsay, 2011). Observation shows participants seek each other out in the online environment to confirm their new found knowledge and seek reassurance. Informal online synchronous interaction about the readings and technology leads participants towards the second stage of Brown's community-building paradigm (2001) where acceptance into a community is conferred after participants engage in discussions of importance with others.

Role plays are not widely used in online tertiary teaching (Douglas & Johnson 2008 p.105) despite the contribution they can make to practical skills development, due mainly to logistic and technical restriction. In the Dispute Resolution unit the two week intensive block is structured around eight seminar topics that provide the context for role-play. Participants are introduced to a case file which they work on continuously throughout the intensive. The role-play activities involve taking on different roles and perspectives in relation to the case. It is at this point that those undertaking the unit move conceptually from being ‘students’ to ‘participants’. The role-plays are recorded and assessed and this places an imperative on the students to engage fully with the case and the community that is invested in its resolution.

The role-plays are conducted using a version of the online fishbowl approach. As described by Douglas and Johnson (2008, 2010), online fishbowl role–plays may stop and start as participants jump in and out, for example ‘to consult relevant literature before deciding on mediator interventions’ (p. 97). The lecturer can also model ‘appropriate mediation and legal practice…by jumping into a role to demonstrate ‘best practice’’ (ibid.). In the Disputes Resolution unit, however, it is not just the role-play but the entire two week intensive that represents an online fishbowl. In the virtual environment video and audio link internal and external participants and spaces, and fluid engagement between participants is possible across space and time zones. Participants move in and out of a number of role-plays related to each seminar topic rather than in and out of individual role-plays and everything that happens in the online environment is seen and recorded.

Peer review of role-plays and individual journals of the process embed observation and reflection as processes of legitimate peripheral participation. These observations and reflections are linked to a final take home exam, done after completion of the intensive, requiring students to look back at their journal and reflect on the learning that took place during the intensive.

Technological perspectives

The design of the Disputes Resolution unit reflects an understanding of new possibilities. These are afforded by new technologies alongside a vision of connected, innovative and interactive online learning environments. The use of this technology enables external participants to experience a real-time animated environment containing audio, visual and motion and allowing multi-channel audio and visual communication between internal and external participants. The aim was to overcome some of the early deficiencies of virtual classrooms, for example, that ‘even where the virtual classroom’s video capabilities are utilized, students nevertheless lack sufficient aspects of context, peripheral vision, continuous auditory environment and continuity of feedback through facial expressions and other means, all of which are inherent characteristics of the face-to-face classroom’ (Parish, 2011 p.431). This criticism is mitigated in the Disputes Resolution unit where the 180 degree peripheral vision and a continuous auditory environment supported by continuous text chat transforms the external participants from passive peripheral entities into panoptic observers sharing power with the internal participants (Foucault, 1977).

Feedback

The Dispute Resolution unit has been extremely successful at connecting internal and external participants in a practical higher education unit. When the new Dispute Resolution unit was delivered in 2011 a voluntary and anonymous participation satisfaction questionnaire was made available to participants on line. The questionnaire asked what could be improved in the areas of teaching, content and technology. A small return rate of 29% (10/35) was achieved with 100% of those responding providing positive feedback on the unit, including comments such as ‘I found this to be a wonderful learning experience’, ‘A really engrossing unit, the best so far at CDU’ and ‘I feel it is one of the most important topics in my degree, and this utility is because of the ample opportunity provided for ‘practical’ application of topic content. In short the class involvement and participation ‘made’ this topic what it was. However with such a small response rate it is impossible to tell if this is an indicative response or the views of a vocal minority.

The success of the redeveloped online unit is demonstrated by an increase in student enrolments, with eight-fold growth from 2010 to 2012. Enrolments in the unit increased from 18 students in 2010 to 28 in 2011 (the year the unit was introduced in its new form) and to138 in 2012. There are a number of factors that make the unit attractive to law students. The unit is the only practically oriented dispute resolutions unit offered fully online at an Australian University. The intensive format of the unit with course content largely covered in a two week online intensive block increases the availability and attractiveness of the course for students who prefer this mode of study. The unit is practical in nature and accordingly does not have an externally invigilated exam but instead has practical assessments which build the case file. In addition, the unit develops useful and practical mediation skills that can be applied broadly, in the practice of law as well as in business and community contexts (Douglas & Johnson 2008 p. 95). These factors cannot on their own, however, explain the high growth in student numbers in the year following the redevelopment of the unit. The satisfaction surveys suggest that word of mouth endorsement has led to some of the increased enrolments in this elective unit.

In 2012 and 2013 the participation satisfaction questionnaire was replaced with an ethics approved qualitative survey for use in a longitudinal study. In 2012 responses were received from 20.89% of students (28/134). While continuing to receive highly positive feedback on the unit, its popularity and the subsequent growth in student numbers impacted on the effectiveness of the pedagogical approach. The student responses indicated a sense of frustration with the inability of the lecturer to keep up the pace of synchronous lecturer interaction simultaneously with multiple student groups during online role-plays. The growth in numbers in the Dispute Resolution unit after the redesign of the unit highlights some challenges in developing connected, innovative and interactive learning online. The pedagogy employed in the unit was highly effective in 2011, the year it was introduced. When student enrolments grew to over 100 the following year it became clear that the pedagogy was not suitable in its current state for large groups. With large numbers, the speed of role-play interactions was beyond the capacity of the lecturer to control and facilitate in real time, thus diminishing the opportunity for expert participation and modeling. The dilemma was then to restrict the enrolment numbers or redesign the unit. The compromise was to use tutors to facilitate 3 streams of students.

While the technology held up with the increase in student numbers, glitches with technology did occur along the way. A full time technical expert and advisor worked alongside the lecturer for the duration of the development and for each of the intensives but this may not always be the case. With respect to the design, implementation and sustainability of innovative online environments while much is possible, a high level of technical support and lecturer expertise is needed to bring the possibilities to fruition and to sustain them over time.

Conclusion

With the pace of technological development occurring at a faster rate than the development of new pedagogies there is a risk that the use of new technologies in higher education will not live up to the potential for connected, innovative and interactive learning experiences and environments. The Disputes Resolution unit at CDU, however, demonstrates that at the point where theory, pedagogy and technology intersect to influence online learning design the possibilities afforded by new technologies can be realised. In this unit, interaction takes place between internal and external participants in practical and interactive role-plays in a synchronous online environment. The nature and structure of the learning activities build a connected community of practice between the participants and lecturer. The development of new software and the increasing speed and allocation of internet bandwidth allows the seamless audio and visual interactions to takes place in the Disputes Resolution between internal and external participants. Despite some concerns with the sustainability of learning innovations that require high levels of technical support, it is clear that technology is providing opportunities for innovative online teaching practices in higher education.

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Chemtunes: a pilot study of setting the rote to music

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Rote learning can be dull! Yet for students to be successful at higher levels of education, there is a large base set of knowledge or vocabulary that must be learned and recognised, despite the absence of any rhyme or reason in said knowledge. This is commonly true of many sciences and languages. Historically, such information has been learned by rote and drills – both quite effective techniques, but not very engaging. The current project investigates the production of musical parodies with lyrics attuned to the knowledge requirements of the student as a means of increasing accessibility, student interest and overall information retention. The success of this work-in-progress venture will be explored through student participation, feedback and results on related examination questions.

Keywords: Chemistry, rote, learning, student engagement, functional groups, music.

Context

Underneath many science disciplines lies factual data that is fundamental to that field of study and usually assumed knowledge once beyond the introductory level. Where would we be if some memorisation or learning of these facts had not taken place? Perhaps with a physician who wasn't sure if the radius bone was in the arm or the leg trying to treat us! A chemist who did not remember the difference between an alcohol and a ketone might be very dangerous in the laboratory.

Many students have difficulty in remembering this type of basic factual data that underpins more advanced material in many scientific disciplines. For first year chemistry students, one such dataset is that of functional chemical groups, for example: alkanes, alcohols, and ketones. These are the workhorses of reactions and all manner of organic synthesis, analysis and other chemical interactions.

This paper explores some ways of helping students to remember properties, associations and limited facts about functional groups, via the medium of music. We suggest that this will enable the fundamental learning of these facts. Our method was to make use of well-known tunes and writing specific lyrics to provide the factual information in a novel and helpful way to aid student learning and recall of this information. We also argue that the vehicle of music and lyrics could be generalised to other science disciplines.

Purpose

We argue that using well-known contemporary music and novel lyrics will aid learning and recall of chemical functional groups.

Literature Review

There's no avoiding it – becoming well versed in the sciences requires some level of rote learning. One area that offers similar challenges to chemistry or science is learning a foreign language. Here vocabulary, grammar and other rules need to be mastered and used with minimal referencing. Paul Pimsleur was a language expert and educationalist that developed a system for learning languages still widely used today (Pimsleur, 2013). He identified the use of "…intonation, rhythm, melody and pronunciation…" to engage students. The focus was a graded presentation of new words and their use (Pimsleur, 2013, p.1). The use of smaller sized portions of information was therefore a recognised method of learning.

In chemistry, the literature is sparse on the topic of using music for chemistry learning. More generally, it appears that music for learning is divided into two streams: that specifically for learning music (which is not particularly relevant for this investigation), and that where music is a tool for assisting learning material in other disciplines. This is particularly noted for the primary school curriculum (for example, Easton 1997, Young and Glover 1998, Bearne 1998, Dyson 2003).

For classroom learning, the use of music is a potent device as there are emotional processes that provide strong links to memory (Wolfe, 2001). The use of 'piggyback' songs – a familiar tune with new words, such as *row your boat* or *happy birthday* – have been documented as successful (Wolfe 2001, Ortis 2008).

Additionally, providing the means for students to easily access the music, tunes, and songs will enhance retention and recall. For example, Ortis (2008. p. 202) reminds us of singing or chanting to learn the letters of the alphabet (ABC), or rhyming "Thirty days has November, April, June and November…" to illustrate the lasting effect of these rhythmic pursuits.

This type of rhyming and singing brings to mind television and radio advertising with its use of short musical grabs, commonly known as 'jingles'. Advertisers know this phenomenon well and exploit it greatly with its repetitive nature until we can all sing along with the current product or service (and more to the point, recall the name of the company, which is exactly the aim of the advertising agency). The research shows that even after a single exposure, individuals made more correct associations with brands and slogans when using a jingle compared to those who had not been exposed to the jingle, but essentially the same visual information (Yalch 1991).

Following on, the use of piggyback songs has been applied in statistics with remarkable success by Wilson VanVoorhis (2002). She utilised tunes such as *Yankee Doodle* and *Coming Round the Mountain* with specific lyrics relating to concepts such as means, and standard deviations to assist students learn basic statistical concepts. The results of this work showed that 55% of students with the songs scored perfect knowledge test scores, compared to only 38% with perfect scores in another group that did not have the songs. Wanda Wallace (1991) demonstrated that for large amounts of information (80-85 words), content delivered via song was more effectively recalled than content delivered by the spoken word.

With chemistry, the use of music has provided some traction in the past with explorations by Flanders & Swann, with *First and Second Law* (nd), relating to thermodynamics and Tom Lehrer with his version of the periodic table, *The Elements* (nd). This style of presentation grew out of university student revues of the 1950s and 1960s, which are rare in current times. More recently, J. G. Eberhart used a blues tune *Brown's Ferry Blues* (2013) with the lyrics rewritten as the *Old P-Chem Blues*, relating to the study of physical chemistry (Eberhart 1995). This was a long piece, typical of the ballad style of blues genre from which the music was taken. His reflection of their being "…an apparent void in the music of science…" which he believed needed filling, was encouragement for our project (Eberhart 1995, p. 1076). More recently, Pye (2004) wrote parodies of modern pop songs in an attempt to re-enforce the concepts taught during a day's classes. Feedback from his work was largely positive, indicating that this approach may be appropriate for assisting in education.

The project is based on the premise that in many disciplines of learning, there is a need for a foundation of knowledge in order to be able to build and expand (Novak, 2002; Johnstone, 1993). Ready and retrievable access to facts and basic knowledge is essential to provide the foundation. In the past, learning drills, or rote learning, has served this purpose (Johnstone, 2000; Sirhan 2007) Rote learning activities are typically not stimulating for the student and go against most good pedagogical practice, where understanding the material is considered to provide deeper learning. The current project follows a similar set of principles to that of Pye (2004), instead focusing in particular on the difficulties that students have with rote learning.

Dillinger and Landrum (2002) showed that people are far more likely to remember musical lyrics than other random bodies of text. Because it is more ‘fun’ this means that students are more likely to engage in the learning. It will provide a memory cue for students, even when they are in a stressful situation like an exam. Music also provides a portable way of learning; you can listen to music while walking, driving, on the train or exercising, whereas memorising a written list is less flexible. This also fits with the Pimsleur approach with its 4 key principles: graduated interval recall, principle of anticipation, core vocabulary, and organic learning (Pimsleur 2013). Our aim was to step away from traditional rote learning and provide engaging ways of learning and recall for the student to use in future advanced work.

Approach (methodology)

Some preliminary work carried out in chemistry in semester one for cations and anions indicated the potential of this type of learning model. Over the semester, 70% of enrolled students accessed the song. A large number of students accessed it within the first 2 weeks of being introduced to the topic, followed by sporadic use throughout the semester and finally, an increase in use in the week before the end of semester exam. Overall, the song was accessed 520 times by 140 enrolled students.

The approach involved several steps. First was to select the chemical functional groups and summarise succinctly their properties (including structure), and perhaps create an *identity*, to be characterised in the lyrics. Second was to brainstorm contemporary, well-known music and songs and select out some with simple *sing-along* properties (more memorable to the authors). The third stage was to try and match where possible the *identity* with the *feel* of the music (blues, rock, ballad, etc.). Lyrics were written to match the metre and feel of the music, and some recordings were made by the authors to test the overall feasibility and logistics of the process. The fourth stage was to record the music and lyrics using fairly simple recording equipment but with a reasonable level of quality and have them ready for implementation in the second semester chemistry class.

The song series was created in two formats as part of the learning material. The first was an audio of either the complete set of Chemtunes, or individual audio files related to each functional group. At the point of writing this paper, songs had largely been largely recorded and uploaded to Blackboard for student access during the teaching period. No feedback on the current status from students has yet been obtained and some will be available by the end of semester in October 2013.

After receiving ethics clearance, we plan to subsequently review the pilot study with student feedback, scores on tests, and other relevant data.

2.1 Why functional groups?

In chemistry, there are several situations where a foundation of knowledge must be remembered and there is little in the way of systematic patterns in the information. The identity and recognition of a variety of organic functional groups represents one such list. Chemists need to be able to identify what type of organic chemical they are working with in order to be able to predict the way that the chemical will behave. While the identifiers are not challenging individually, the range of different functional groups to be recognised means that at least 9-10 different possibilities must be memorised in order to be recognised, and these are clouded by their superficial similarity to the inexperienced. These criteria make the learning of different functional groups an ideal task for the current study.

2.2 What is the intended message?

The aim is that students will be able to recognise a chemical functional group on sight. Traditionally in chemistry students are taught a list of functional groups, as shown in Table 1. It is our intention to use music to help students familiarise and learn this list.

Table 1. List of common organic functional groups and their common abbreviation

Functional Group	Abbreviation
Alkane	R–R
Alkene	R=R
Alkyne	R≡R
Alkyl Halide	R–X
Alcohol	R–OH
Carboxylic Acid	R–COOH
Ketone	R–CO–R’
Aldehyde	R–CHO
Primary Amine	R–NH_2

2.3 Selection of music

The selection of music is of great importance – the most appropriate choice would almost certainly vary from one application to the next. Others have written and performed original music as part of a learning activity. For example, Mark Rosengarten (2009) has used original rap music to illustrate some chemical concepts. These are used with a video to describe some chemistry concepts, but miss the feel for *sing-along-yourself* type of tune, as they are the same genre without differing for different concepts. Using original music has advantages in that the pacing, style and lyrical requirements can all be tailor-made to suit the learning activity, but there is a need for variety.

The advantage of well-known music over original music is that if this activity is to help students remember what might otherwise be random information, then stronger memory cues are better. If they can associate their new knowledge with something they already know – a well-known song – then it is likely that their ability to recall the information will be greater (Ortis, 2008). The availability and accessibility of music also provides great opportunity for variety so that different concepts can be illustrated.

The goal of this learning activity is to allow students to be able to differentiate between one organic functional group and another. If a unique song is associated with each organic functional group, students will come to associate that particular functional group with a particular lyric or song, rather than getting multiple options confused. This also means by selecting songs that have a distinctly different sound and feel that easily confused functional groups (e.g. alkane and alkene) can be more easily separated.

Based upon the work of Wallace (1991) in advertising, we decided that songs should be chosen to meet the following criteria:

- Well known by a large proportion of the population (each song selected has at least 2.5 millions views on YouTube, suggesting they are well known)
- Not too modern, so that the music has been around long enough to permeate through society
- Easily coherent lyrics
- Different speeds or tempo to provide variety
- Different driving instruments/sounds to provide variety
- A mixture of male and female vocals to further differentiate the songs

These criteria were adhered to in order to maximise the audience’s ability to recognise the songs, hear the modified lyrics and be able to mentally distinguish one tune from another.

Below is an example of a song modified to introduce the keys to recognising alkenes. Alkenes are compounds that contain a double bond between two carbon atoms. The major learning outcomes that we would like from this song are that students can recognise an alkene on sight and are aware of the fact that their double bond is important.

The lyrics are replacements for those of the song, “Stuck in the middle with you” by Stealer’s Wheel.

I’m an alkene, I’m a double bond
I’m an alkene and I know what I do
I take part in addition reactions
My double bond is easy to use

Carbon to the left of me, carbon to the right
Double bond, stuck in the middle of two (two carbons)
Double bond, stuck in the middle of two (alkenes)

2.4 How to blend the music

Instrumental and vocal tracks can be individually digitally recorded and mixed using any number of software packages such as Steinberg’s Cubase, Ableton Live, Garageband, or free programs like Audacity, Free Audio Editor, Music Editor Free, Power Sound Editor or Wavosaur. Many of these packages come with equalizers and effects to enhance musical creations and some support the use of VST (Virtual Studio Technology) plug-ins – 3rd party audio utilities that can be used to further enhance recordings. We made use of several packages to record and engineer our music.

Previous *mash-ups* and musical compositions by others have been carefully engineered and arranged so that changes in key or pace are smoothly incorporated into the musical score, resulting in a seamless transition from one phase of a musical piece to the next. In the current project, this approach was discussed and abandoned in favour of a more definitive divide between tunes, and this served two purposes: the first to have a distinct cut-off between each functional group for students to learn; and the second to make it easier to join together a series of otherwise unrelated pieces of music.

With this in mind, each short piece (or segment) of music was individually composed, one instrument at a time with multi-track recording and then the desired segments were joined together, using a radio distortion sound to create the feeling of one tuning a radio to a new station while separating one functional group’s song from another.

2.5 Associated resources (video/slides)

To further assist in the goals of the project, associated video content was produced to synchronise with the audio compilation. The video material contained visual images of the organic function groups, placed in time with the relevant features of each song in order to further enhance student recognition of the relevant functional group’s structure.

Colour was also used in conjunction with the video to further distinguish between one functional group and another, providing additional learning material to help differentiate similar structures.

Outcomes

We used the song series as part of the learning material available on mp3 fie to download. This was either the complete set of Chemtunes, or individual files related to each functional group.

Based on this positive early response, we expect that there will be a general interest in the future use of this method by students and other staff within the faculty. We also expect that as a result of the novelty and catchiness of the songs, students will retain more of the factual information and have a better understanding and recall of chemical functional groups. We may be able to judge this partly on comparison of performance in chemistry with previous years and/or comparison of short tests on functional groups over the same time period from the semester 2 results when the functional group learning has taken place.

We will report on the findings from the second semester implementation of Chemtunes, detailing the songs, lyrics and music (with examples) and some indicators of effectiveness based upon a mixture of assessment results, student feedback and comments (subject to ethics committee approval).

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The Village Pharm: Flipping the classroom to enhance the learning of pharmaceutics and associated professional skills

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Abstract: A growing body of knowledge in Pharmacy has made it increasingly difficult to keep abreast of current knowledge and developments in disease prevention and treatment. It has been suggested that in the face of this ever-changing knowledge environment, it is essential to help students develop professional capabilities in classroom (Blouin et al., 2009). Here we present an experiment called the village pharm – a model that used the flipped classroom concept. Our aim was to teach students professional skills in context, mirroring key skills including communication, empathy, cultural and ethical awareness expected of health professionals. Using auto-ethnography, we present our design, reflection and analysis of how learning unfolded in a flipped classroom and the lessons we have learnt to make improvements for the future. We believe this will be useful for academics wishing to use flipped classroom and technology to help students develop key professional skills inherent to their discipline.

Keywords: flipped classroom, video animations, professional learning, auto-ethnography.

Introduction

Pharmacists are health practitioners employed in the fields of community, hospital and industrial pharmacy. In addition to dispensing drugs there is a growing recognition of the importance of clinical pharmacy services in patient care and the associated acquisition and interpretation of knowledge required for the dissemination of information to patients (Ried & Posey, 2006). Pharmacists also provide information and advice to medical practitioners about optimal drug therapy and disease state management as well as educating allied health professionals on the quality use of medicines. A unique aspect that pharmacists bring to the health care team is the knowledge and skills in the area of pharmaceutics, a discipline of pharmacy that particularly deals with the process of turning a new chemical entity into a medication, and the design of devices for the delivery of medications to patients.

Noble et al (2011) noted that often it is assumed in the pharmacy curriculum that if students acquire the necessary knowledge and skills they will "become" pharmacists. However, in the new paradigm of pharmacy practice, a curriculum that focuses on acquisition of knowledge and skills may not develop the required professional skills and capabilities. It was proposed by these authors that a curriculum needs to afford students the opportunity "to do" and "to be" pharmacists and in so doing, not only does learning occur but the student learns to think, act and do things differently.

The existing approach to teaching pharmaceutics in our Pharmacy program consisted of traditional lectures followed by tutorials. This provided little opportunity for our students to practice being pharmacists. It was also evident through feedback from other academics and pharmacists that even towards the end of their degree, students were unable to use and communicate their pharmaceutics knowledge in problem solving clinical scenarios. With these factors in mind, it was decided to redesign the pharmaceutics course in the first year of the degree allowing students the opportunity to practice being pharmacists. In this paper we present our model "the village pharm" - a technology assisted case-based approach to learning pharmaceutics and associated professional skills in context, which was built around the concept of flipping the classroom as illustrated in Figure 1 below.

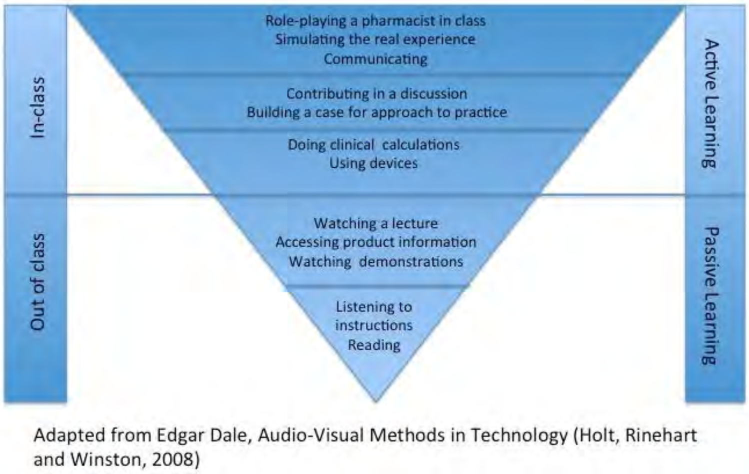

Figure 1: Our model of flipped classroom

Development of the "Village Pharm" model

The development of this model involved changing the way the final pharmaceutics course was delivered to students. Information and content in the course was delivered using pre-recorded audio-visual presentations – replacing the traditional lectures and tutorials. The audio-visual presentations were created using Adobe Captivate® and Articulate Pro® and were made available online through Blackboard. Tutorials were changed to facilitate patient focussed learning (real-world learning) instead of examining pharmaceutical products or devices and answering directed questions, which was product-focussed learning. The concept of the "Village Pharm" was thus conceived to provide an overall context for case studies students were required to work with throughout the course. The village pharm is a virtual village and students are welcomed into the course and the village Pharm as the new pharmacist to work at both the local hospital and community pharmacy. The case studies involved residents of the village of different ages, some from the same family and others who were teachers or health professionals working in the village. In order to make the case scenarios more realistic, animations were created using Crazytalk Pro(R). These animation videos with speaking characters were used to present the case scenarios. An example of the animation is shown in Figure 2 below.

Figure 2: Example of character in an animation video created using Crazytalk Pro®

In some case scenarios, students are required to work as a group to produce resources that would be used in some aspect of health care in the village. In other scenarios, students are required to role-play being either a pharmacist or the patient/health professional receiving advice. For the case scenarios, students are required to work collaboratively in defining the problem, identifying learning goals, planning their approach to learning and then synthesising the outcome. To assist them with this approach, students are introduced to the continuing professional development cycle (CPD) in an introductory session in the first week of the course. The cycle of identifying learning goals, planning how to address learning goals, addressing learning goals and evaluating/assessing outcome was explained to them. The importance of learning to use this CPD as part of their professional development is also emphasised. In the introductory session, students are guided through an example case study by the tutor and lecturer. Throughout the course, students are required to document their learning in a learning portfolio. This portfolio should be constructed around the learning goals for each case study, providing artefacts, personal reflection on their learning as a pharmacist.

Data collection

An auto-ethnographic approach was used to collect, analyse and synthesise our experiences in developing and implementing this model. Auto-ethnography is a form of qualitative research that analyses documented self-reflection of the researcher's personal experience, connecting it with wider culture, meanings and understandings inherent within a context. The context here is the flipped classroom and data was collected in the form of critical reflection, documented as a narrative. The process of critical reflection is an integral part of teaching practice and involves reflection in action, reflection on action (thinking retrospectively) and reflection for action (thinking and planning for future teaching practice). The data collected for this research involved personal reflections of the lecturer and the tutor. Thoughts about the redesigned course in action, on action and for action were documented by reflecting on the experiences of teaching the course, student learning experiences, peer feedback and the vast body of knowledge from the literature on student learning in higher education. Data was also obtained from student feedback on course survey conducted by the University and from an online questionnaire in which students were invited to reflect on their learning experience.

Analysis and synthesis of results

Based on data obtained using the auto-ethnography approach, it was apparent that many students were unprepared and felt unsettled when they were asked to take responsibility for their learning. Students also requested different formats for information and resources besides the audio-visual material, with some requesting printed material. Students reported that they initially struggled with having to determine learning goals for the tutorial scenarios but this appeared to improve with practice. They felt that number of scenarios included in the tutorials was overambitious and made it difficult for them to spend sufficient time to master the skills required. However, students expressed concerned about the final exam for the course which they were informed would require application of learned skills and knowledge to scenarios rather than just regurgitation of information. Students also found the workload heavy and worried about the final exam.

Data collected from the lecturer and tutor evaluation of the course painted a rather positive picture. Reflections on learning interactions indicated that the sessions enabled the good interaction. It was noted that students were very motivated, and when prompted they were comfortable asking questions and supported each other during group discussions, role-playing and working on case scenarios. As the course progressed, there were noticeable improvements in the quality of discussions and the way students communicated concepts and ideas during class time. Students also seemed to enjoy role-play scenarios, counselling and use of devices. Some group process issues came to the fore as a small proportion of students preferred to work individually. The quality of the learning portfolios produced by the students indicated that most had approached learning at a deep level.

Intrigued about the differences, we examined the student feedback on the newly designed course and compared it with the previous year's feedback. We found that there was a decrease in overall satisfaction with the course. It is important to note that only approximately 20% of students responded in each year and the surveys questions were focussed mainly on their feelings. Although, students were able to comment there was not enough information to come to a conclusion about the success or failure of the village pharm. Hence we sought out to obtain more feedback through online survey about student learning experiences. A common theme that emerged from this data was that students preferred traditional lectures, although one student did comment " I didn't think self directed learning would work for me but in the end it did work- it gave me more flexibility in terms of time and more time for me to learn on my own" and another commented that online material was "convenient". Students reported that they enjoyed the case-based tutorials and that from these tutorials they found that practising counselling and explaining concepts to patients was beneficial to their learning, that they "learnt something that is useful in community settings" and things they "could apply to working in a pharmacy later".

Discussion

Our analysis revealed that the pharmaceutics course in its traditional form appealed better to students. From this, many educators may be tempted to ask- why change the format? However, from a teaching perspective it was evident that students were not developing the professional skills relating to critical thinking, communication and being able to apply their knowledge in the clinical setting. As educators, we have a responsibility to reflect on the learning achieved and when this does not meet what is required, we need to consider strategies to improve student learning.

Problem based, practice based, scenario based, case based and other active approaches to instruction allow students to actively participate in learning and solving authentic real world problems in the classroom (Barrows & Tamblyn, 1980). Problem based and case based approaches to learning are particularly designed to help students develop key competencies that will serve them in their professional lives. Learning activities typically involve students identifying their learning targets, learning individually and in groups and applying their learning in solving clinical cases (Dupuis & Persky,2008). These instructional approaches empower students to be self-directed, interdependent and independent learners (Evensen & Hmelo,2000). Taking this literature into account as well as the observations by Noble et al (2011), a case-based approach where the students have to "be the pharmacist" was chosen as a way to develop the professional skills required. Applying a continuing professional development cycle approach within these scenarios of developing learning goals and working both individually and in groups also introduces them to and allows them to practise and develop the skills needed for lifelong learning.

A major challenge was to try and move the student focus from approaching learning at a surface level to one where they develop new skills by applying core knowledge to solve problems and practice being a pharmacist through role-playing. We flipped the classroom to change this focus and allow for more active learning. That way real world experiences can be simulated in the classroom, preparing students for work readiness. This approach also reflects what students will need to do when practising, where they are no longer under the guidance of the lecturer.

When changing our approach, educators will invariably find that students are uncomfortable. Their discomfort was evident from student feedback. Student concerns about learning portfolios and not knowing how to study for the exam was not surprising. It indicated that they were focussed on doing well in the course. We assumed that students completing this Pharmacy degree would have developed and adopted learning strategies as they all come to the degree after completing an undergraduate degree.

Although this may be the case, we found as Biggs &Tang (2011) identified, that students are more likely to feel comfortable in familiar situations and often change their approach to learning based on the affordances of the situation. That is, a student who usually approaches learning at a deep level may change their approach in a new situation or when they know that a surface learning approach can yield them the required outcome, they will be happy to do this. The previous design of the course was likely to encourage students to use a surface learning approach to achieve their goal. By changing the focus of the course to one where the assessment required applying knowledge and using professional skills developed during the course, this would produce discomfort as surface learning was unlikely to be a successful approach.

Conclusion

From this experiment, we have learnt that it is important to support and guide students in adapting to these new approaches. Also, it is important to cater for different learning styles and wherever possible offer both audio-visual and printed material to support student learning needs. Developing the online material and animation videos does require an initial investment of time but, once developed, these resources would be reusable for a number of years. It is important to remember that the information supplied to students should not just be a replica of an entire face-to-face lecture recorded or written. There is a temptation as a lecturer to try and tell students everything they need to know to solve scenarios and problems. As lecturers we need to consider carefully what information needs to be provided and what students should develop on their own.

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Turn on the book: Using affordance theory to understand the adoption of digital textbooks by university lecturers.

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Adoption of digital textbooks in higher education has been slower than was expected. This paper presents preliminary findings from a study conducted at a small Australian university looking into how lecturers use digital textbooks. The pilot research indicated that the slow uptake may be explained by academic perception; participants indicated a strong preference for printed books, particularly related to capacity for accessing content. This pointed to a definitional property in that they largely conceived of an etextbook as a digital replica of a printed book. Not all lecturers were aware of enhanced digital textbooks, but generally agreed that it could be advantageous to have such content integrated into a central resource. Lecturers furthermore acknowledged the need to understand the affordances of educational technologies and their application to learning and teaching. Affordances theory is used to consider the knowledge required to effectively implement the full range of resources available in digital textbooks.

Keywords: eTextbooks, digital textbooks, affordances, enhanced ebooks, higher education, learning and teaching, innovation

Introduction

The textbook has a long established tradition in higher education, but lecturers today have many more choices available to them including digital textbooks, companion websites, and interactive study guides (Martin, 2012). Despite these choices, or perhaps even because of them, the printed textbook remains a popular choice in Australian universities, and even though there is evidence of a subtle shift toward digital resources, these tend to be used as complements to the printed textbook (Horsley, Knight, & Huntley, 2010).

There are obvious benefits to not having to carry around a bag of heavy expensive textbooks, and coupled with the ubiquity of mobile devices, there seems to be good grounds for the early predictions that digital textbooks would gain a significant foothold in education. However, sales of digital textbooks have been steady, but not quite the revolution expected. Despite the advantages of digital books, studies repeatedly find that there is still a preference for print.

One explanation for this preference for print could be that lecturers approach digital textbooks in the same ways as they do printed books, but in doing so, the inherent educational affordances of digital textbooks are not fully realised . The concept of affordances is used to describe the opportunities that objects create for user behaviour. However, these opportunities need to be perceived by the user. Auke Pols' (2011) description-of-affordances model explains how the perception of affordances requires users to possess particular types of knowledge. In the context of books, for example, O'Brien and Voss (2011) wrote "affordances of digital texts allow viewers to respond to and collaborate on texts that had been previously static and unavailable for interaction" (p. 77). Not only do the features of the teaching tool need to be present, they need to be acknowledged and valued by the teachers and learners.

Academic eBooks have featured in earlier research from the perspective of usability and efficacy for university students and on computer screens in university libraries (Lam, Lam, Lam, & McNaught, 2009). The study presented in this paper contributes to this body of research and offers an empirical and conceptual extension as part of a larger project designed to identify how university educators perceive the affordances offered by digital textbooks. In doing so, it presents new findings blended with emerging literature to predict a flatter, and therefore longer, adoption curve for academic eBooks, or digital textbooks. Slow adoption, we suggest, can be explained by Pols' (2011) description-of-affordances model.

Methods

Semi-structured interviews were conducted with seven lecturers at a small Queensland University between February and April 2013 as a pilot for a larger project. These academics were in various humanities, business and health sciences fields. Their qualifications included both PhD and Master's degrees and all had been teaching for ten or more years.

Each interview lasted for approximately one hour. There were guiding questions; however, the interviews were allowed to deviate in response to participants' answers to the guiding questions. Interviews were transcribed and a preliminary analysis involved cross-questioning of the data in order to identify issues to pursue. The transcripts were subsequently coded. This required that each text transcript was read-through multiple times line-by-line with notes being made in the margins to identify content areas and potential themes. Using a different colour pen, memos concerning reflections, questions, associations with the literature and comparisons and contrasts between respondents were then added (c.f., Kinash, 2006). For this study, themes concerning the description-of-affordances of digital textbooks and their role in learning and teaching were identified.

Understanding and use of ebooks

A simple and perhaps obvious definition of an ebook (electronic book, eBook, e-book, digital book) is an electronic version of a book "that can be read digitally on a computer screen, a special ebook reader, a personal digital assistant (PDA), or even a mobile phone." (Nelson, 2008, p.42). However, describing an ebook as an "electronic equivalent" suggests that ebooks are simply digitised versions of printed text like a PDF, and what distinguishes one from another is the device upon which they are read. In some respects this is accurate; for example, on electronic devices, pages can be turned, bookmarks can be placed, contents pages can be scanned just as in a printed book. The digitised versions retain all the content (text, images, charts and so on) that the printed predecessor contains.

Interviews for our emerging research bore this out. University lecturers in this sample defined digital textbooks in terms of how the books are read- "*it can be read electronically*," and the design features- "*there are pages that in some sense can be flipped* ". There was a strong sense that it was an alternate form, or simply an electronic equivalent of the printed version- "*Instead of buying a hard copy, you are entitled to read the book online*", using descriptors such as *"a version"* or "*a reproduction".*

A persistent preference for print was apparent. Notably, participants did not express a dislike for reading digitally, but did express feeling more comfortable reading print. The preference was explained in terms of the physical feel of the book- "*I really like the tactile experience,*" the ease of taking notes and highlighting on paper, - "*I still prefer to use pencils and highlighters,"* the familiarity of print - "*I feel more comfortable with the paper artefact*", as well as navigation difficulties and eyestrain. One participant said she perceived a lack of dollar value in the digital textbook available for her subject. While it was less expensive than the print version, it was still around $90, without any extra features and no potential for resale.

With advances in technology, numerous variations to this standard format have emerged with the development of enriched or enhanced ebooks which contain embedded interactive multimedia features allowing the reader to interact with the text through options such as audio, video, hyperlinks to dictionaries, translators, and other websites, manipulation of images, quizzes, and social collaboration. Early in 2013, McGraw Hill announced the release of the SmartBook, an etextbook which incorporates adaptive technology that uses complex algorithms to continually assess students' knowledge, skill and confidence levels, and based on this information, designs individualized study paths through the content of the 'book' to guide their learning. (See http://learnsmart.prod.customer.mcgraw-hill.com/for-educators/)

When asked about enhanced digital textbooks there were mixed responses. Two lecturers were clearly aware of the possibility of enhancement, and at the same time disappointed that etextbooks of this kind were not widely available. One explained, "*That is what they (ebooks) should be, otherwise they're just PDF versions of a printed book*". The other said, "*I have only seen one but WOW! that is an ebook*". Two of those interviewed were not aware that enhanced ebooks were available, but when the features were explained they expressed enthusiasm about investigating this possibility further, and were positive about how they could be used *"I might be missing something amazing here"*. However, one lecturer who was aware that these extra features are available, was cautious about their potential use- *"That side of it I wouldn't be bothered with. I have some reservations because I remain to be convinced that the quality of learning would necessarily be improved."*

So, a definition predicated on how these books are read, that is to say they are consumed via an electronic device, is only partially accurate. Actually, "reading" an ebook may involve a quite different experience compared to reading linear printed text, as. In fact, it may be misleading to think of ebooks as "books", a point discussed by Anne Kostick, writing for Digital Book World (2012), and in fact she goes even further by suggesting that it is necessary to coin a new term to describe "digital, transmutable, readable, platform-agnostic, weightless, immersive, elastic creation hitherto known as a book". Due to the variations of these digital literary products of which the printed book is the antecedent, she argues that referring to them as books is not only inaccurate and confusing, but may even impede innovation in this area. In the Oxford Companion to the Book, Gardiner and Musto acknowledge that the definition of an ebook is a "work in progress", and furthermore they state that is probably "less useful to consider the book as an object-particularly as a commercial object-than to view it as a cultural practice, with the ebook as one manifestation of this practice' (p.164). Nelson suggests that because of the changing technology, the future generation will have a quite different concept of a "book" than we do (p.44).

Slower than expected adoption

The Horizon Report first highlighted ebooks in 2010 (Johnson, Levine, Smith, & Stone) and smart objects in 2009 (Johnson, Levine & Smith) as emerging technologies that, when combined, may change both students' and lecturers notions of reading all together. The 2012 Horizon report, highlighted apps and tablet computers for their capacity to assist with the transition to digital textbooks (Johnson, Adams, & Cummins, 2012). There have been enthusiastic predictions about the role that digital textbooks would come to play in education. Late Apple co-founder Steve Jobs was quoted to have said the textbook industry was "ripe for digital destruction" (The Economist, 2012). In 2011, Reynolds predicted that over the coming five years, sales of digital textbooks would make up more than 25% of combined new textbook sales in the United States (Reynolds, 2011), and a report prepared by PwC for the Department of Innovation and Industry in Australia projected the growth of educational ebook sales to grow to be in excess of 20% of total educational book sales by 2014 (Department of Innovation, Industry and Research, 2011). There are sound reasons on which to base these predictions. Digital textbooks offer many advantages including portability, instant availability, integrated dictionaries, translators, annotation and bookmarking tools, social sharing functions, text searching capabilities, and lower cost (Martin, 2012). Mobile devices allow readers to consolidate all their content into a single portable device. With so many students having access to at least one type of mobile device, not having to carry around heavy expensive textbooks should seem appealing.

Reports indicate that despite moderate growth in the market, when it comes to the adoption of digital textbooks there looks more like a quiet evolution rather than the revolution that was perhaps expected by some. Data from the United States shows that in the higher education textbook market digital sales are around 20% of overall sales, increasing from 11% in 2011(Bowker, 2013). The Book Industry Study Group (2012) found that print remained the dominant format chosen by college students and faculty in the United States. Even though one third of faculty interviewed had made e-textbooks available as an option for students, only 2% of students selected this as a primary means of accessing content. Between 2012 and 2013, there was a slight increase in the number of students who had purchased a digital textbook from 28% to 31%, but still more than 60% say they prefer print (Bowker). When digital textbooks are recommended by lecturers they are most likely to be complementary rather than sole resources (Horsley, Knight and Huntley, 2010). In the Book Industry Study Group survey 91% of students indicted that print was the primary format for content (Bowker).

Barriers to adoption

While cost and portability are recognised as major benefits of e-textbooks, numerous studies have also identified limitations for both students and instructors (for example, OnCampus Research, 2010; Woody, Daniel, & Baker, 2010; Walton, 2007; Lam, Lam, Lam & McNaught, 2009; Nelson, 2008; Bowker, 2013). Barriers include the necessity of access to an e-reader, lack of durability of e-readers, a limited range of e-textbooks available, the existence of various formats and restrictions on sharing and reading across multiple devices, no potential for resale, difficulties with highlighting, marking up and navigating the book, and pricing. The most common reason for the preference for print is that people like the feel of a book and, in fact, it has been suggested that reading paper was a welcome break from the heavy screen reading that students are required to do (Bowker, 2013).

The role of the teacher

According to Angela Bole, Deputy executive Director of the Book Industry Study Group, lecturers are responsible for any digital shift in classroom textbooks. She explains that even though ultimately it is students who are the consumers of the e-textbook, it is their lecturers who make the decisions about which form of textbooks will be offered (Book Industry Study Group, 2012). Gaffney (2010) also explains how lecturers are considered "gatekeepers" for technology use in the classroom. How lecturers use, or do not use, a technology, has been shown to influence students' use and perception. In a study looking at digital textbook usage in universities in the United States instructors had minimal engagement with the extra features of course eTexts and this impacted on the students' experience of the text with students reporting a better experience when their instructors used the extra features (Internet2 eTextbook Spring 2012 Pilot Report). It is therefore useful to understand the reasons behind lecturers' resistance to the digital textbook. Certainly, technical limitations will impact on their decision to adopt or not, but there could be other less obvious factors as well.

A cognitive perspective

A useful concept for this discussion is the notion of 'functional fixedness', a concept first explained by Duncker in 1945. This term is used to explain an individual's cognitive bias that limits them to using an object only in the way it is traditionally or habitually used (Eysenck, 2001). So, for example lecturers may approach and use the digital textbook in the same ways as they do the printed book, perceiving the functions of both formats to be the same, namely providing text-based content, only with the additional function that the digital version can be read on an electronic device. MacFayden (2011) wrote, "people try to fit the experience of digital reading into mental models derived from print culture" and " the way users understand and describe their experiences of reading on digital devices are shaped by well-established cultural expectations about the abstract as well as the physical affordances of the print book" (pp. 2-3).

Lecturers explained the advantages of digital textbooks in terms of convenience for students, compared with the printed counterpart. *"Why would you lug those heavy textbooks around? They're heavy, they're cumbersome and they're not at your fingerprints".*

Similarly, the disadvantages centred around not being able to do with the digital book what can be done with the hard copy. *"I really like the tactile experience so my preference is for hard copy…I really like to be able to take notes and scrawl on things. They're really hard to follow. I like to be able to flick back and forward through the book."*

However, functional fixedness can inhibit the creative use of technologies (Koehler &Mishra, 2008). Heider, Laverick, and Bennett (2009) claim that it is the interactivity of digital books that offers the most potential, not the readability. They argue that digital textbooks are innovative tools which lecturers can use to meet the needs of contemporary students. The affordances of digital textbooks take them beyond that which is possible in a printed book, but for that potential to be realized the affordances must be recognised.

Affordance theory

Affordance is a term first coined in ecological psychology by Gibson in 1979 to describe the potential that objects have for users. They are the potential for actions offered by the particular characteristics of an object, or artefact. Affordances are opportunities for action (Gibson, 1979). For example the design of a chair affords sitting on and a book affords reading. One of the central themes of affordance theories is the role of perception.

It is generally acknowledged that affordances exist independently of perception; in other words, they are available to be perceived (Michels, 2003), but it is the perceived rather than the actual affordances that influence user behaviour (Pols, 2011).

Non-adoption of digital textbooks among participants in our study implied that there is a resistance to adopting digital for digital sake. These responses demonstrate that for these lecturers it is necessary to learn more about the technology before using it with classes. As one participant remarked, "*Potentially, if you understand the technology and the abilities of the technology, there's the potential for great change of appreciating how … the ebook could be used"*.

Pols' description-of-affordances model

Auke Pols (2011) believes that defining affordances as opportunities for actions is too simplistic as it fails to capture the complexity of many cases. For example, a light switch affords the simple action of "flipping", but on another more complex level it affords "turning on the light", which obviously involves more than one action and affordance. Pols describes four types of actions:

1) Basic action, which is done intentionally and deliberately; for example pressing a button
2) Actions can also be described in terms of their consequences; for example pushing the letter 'A' on the keyboard causes the letter 'A' to occur in a text editor on a screen
3) Multiple actions, or the execution of a plan; for example phoning a friend
4) Social action, or an action which is intentional under the terms of its social consequences, such as making a promise, running for president. These actions may also be a result of the artefact belonging to a particular socio-technical system.

Affordances correspond to actions. Basic affordances correspond to basic actions; these are referred to as "manipulation opportunities". They are directly perceivable and if a user encountered a completely unfamiliar artefact, the affordance would exist simply in terms of what can be done with this artefact, for example it can be pushed, or rolled. Then through experimentation, or gaining knowledge about the artefact, connections can be made between action and possible effects, Pols calls "opportunities for effect". At the next level affordances can be described in terms of what users can do, as distinct from how they act upon it. So then, I push a letter on a keyboard (level 1 letter appears on screen (level 2), write a paper (level 3). Knowledge at this level could certainly arise through experimentation, but it may also be communicated by designer of particular artefacts, for example in a user manual. Finally, it is possible to describe affordances in terms of their social, rather than physical effects. The user would obviously need abstract social and institutional knowledge in order to perceive such affordances, or activity opportunities.

From these descriptions, it is obvious that not all affordances are directly perceivable, nor are they perceived in the same ways by all users. "Defining affordances as 'opportunities for action' means that our understanding of what affordances are can only be as precise as our understanding of what actions are," (Pols, p. 113). Understanding depends on knowledge of the user, and this knowledge is derived from basic cognition as well as prior experiences and extensive knowledge of the variables of the system in which the artefact is being used. One participant in the present study said *"If you understand the technology that could be amazing, but it needs time and training and just being aware."*

Pols' description-of-affordances model characterises the complex levels of affordances and the corresponding knowledge required to perceive the affordance of artefacts at each level of description as shown in Table 1.

Table 1: The descriptions-of-affordances model (Pols, 2011, p. 120)

Affordance	Corresponding concept action theory	Knowledge needed	Example (using e-readers as examples)
Opportunity for Manipulation	Basic action	Neuropsychological (low cognition)	Turning on an e-reader, pressing a page-turn button, swiping the screen.
Opportunity for Effect	Action described in terms of effect	Neuropsychological, perhaps knowledge of functions of part or cultural symbols	Change the font, type size, page margins, text colour, brightness, highlighting, bookmarking
Opportunity for Use	Plan	Mental models, use plans	Installing a book
Opportunity for Action	Social action	Abstract institutional and social knowledge	Collaborating with other readers via social bookmarking

Educational affordances

Educational affordances are characteristics of an artefact that determine if and how a particular learning behaviour can possibly be enacted within a given context. It can be seen as the relationship between the learner and the technological intervention, and how learning is enabled through this interaction (Kirschner, 2002). Pols' categories can be understood in terms of educational affordances. The lowest level affordance, *Opportunity for Manipulation* affords the opportunity to read digital materials. At the next level, *Opportunity for Effect* lies in the effects of users' manipulations. Setting exercises around words in textbooks to take advantage of on-board dictionaries and translators is an example. *Opportunities for Use* occur when educators relate the effects of manipulation to curriculum, and innovation migrates from hardware and software to new ways of doing. This level of affordances involves thinking, planning and coordinating complex use for a larger purpose. Educators are already aware of the educational affordances available with various media, and actively incorporate a wide array of media into their teaching. Enhanced or enriched textbooks may incorporate audio, video, simulations, models and quizzes, thus allowing much greater interaction by the user. The newest and most advanced digital textbooks afford the receiving of instant feedback and diagnosis of a user's understanding of the content and the creation of individualised learning paths. However, it is the *Opportunity for Action*, the highest level of affordances in Pols' model, which can serve educational technology policy and practice most powerfully. As e-readers take advantage of social media and crowd-sourcing, the opportunities for action have the greatest potential to re-invigorate the classroom. Opportunity for action is coordinated and social. E-reading devices often afford highlighting and note-taking of texts and being able to manipulate and share these annotations with others remotely creates an opportunity for action which goes to the very notion of constructivist and relativist learning.

While much has been written about how the affordances of digital technologies, including etextbooks, offer innovative pedagogical application in the context of higher education, in order to achieve effective learning outcomes, it is necessary to perceive how the unique attributes of digital technologies can be used to create learning opportunities, and this goes beyond the fundamental functions. Day and Lloyd (2007) argue that it is counterproductive to view learning outcomes as being dependent just upon the attributes of the technologies. Even though a technology might possess certain attributes which could be perceived as affordances, other factors may interfere with the actualisation of a learning opportunity. The educational context is a complex interaction between lecturers, students, and a range of other factors and learning outcomes result from this interaction. Pols' model demonstrates how knowledge is essential in the realization of affordances, and it is important to recognise that this knowledge extends beyond just that of the basic affordances of the artefact.

Lecturers in this study were mindful of this necessity. As one lecturer stated: *"Digital stuff tends to look like entertainment. Getting it right as to how you set it up, how you make it an activity or make it a component of the entire knowledge environment is not easy."*

All of the lecturers interviewed for this study were familiar with ereading and had used various devices for ereading. They also actively incorporated digital resources into their teaching, including Blackboard tools, videos, links to websites, online manuals, mapping tools, electronic dictionaries and translators. They expressed their purpose for doing so in terms of student motivation and engagement, and practical and authentic learning. They further acknowledged that time and effort is required to understand the technology in order to be able to use it effectively. So, on one hand a lack of time to understand the potential for digital books is expressed as a limitation and a barrier to adoption, as expressed in this comment- *"I haven't fully explored what all the opportunities are here and without dedicating some time to exploring it, I would feel less comfortable promoting the e-version*".

The importance of integrating any teaching and learning resources with the pedagogy is acknowledged. The lecturers in this study recognise the complexity of decisions around how to best incorporate any resource into the educational context, as exemplified in this comment- *"I dislike the idea of elements of a course being used in isolation. A course should come together as a whole. So a textbook should be integrated as a part of the learning experience."*

Conclusions and Future Directions

Based on these preliminary interviews and the available literature, the following findings emerge.

- In terms of accessing content in text form, the print book is preferred.
- While not all lecturers are aware that digital textbooks can have extra features embedded, there is generally agreement that it could be advantageous to have such content integrated into a central resource.
- Almost all of the lecturers interviewed believe that enhanced textbooks could have significant potential for learning and teaching.
- Lecturers recognise that extra knowledge is needed to understand educational technologies and affordances and how to best incorporate them.

The role of the etextbook in the broader macrosocial educational context must also be considered in future studies (Figure 1). In 2007, McLoughlin and Lee discussed social software tools and the potential they offer to students to have greater control of their learning through their social affordances. They also argued that if these tools are used with both a detailed understanding of the affordances and with thorough planning, there is the potential for radical transformation in the curriculum. Some years on, it is now evident that transformation is occurring with the emergence of innovative approaches to education. At this broader macrosocial level, the affordances of etextbooks not only lend themselves to use in this changing landscape of higher education, but could in fact be an essential component. For example, etextbooks offer easy access to resources for MOOC participants, student autonomy and interaction in the flipped classroom, interaction and collaboration in gamified classroom, and social sharing and knowledge in constructivist pedagogy.

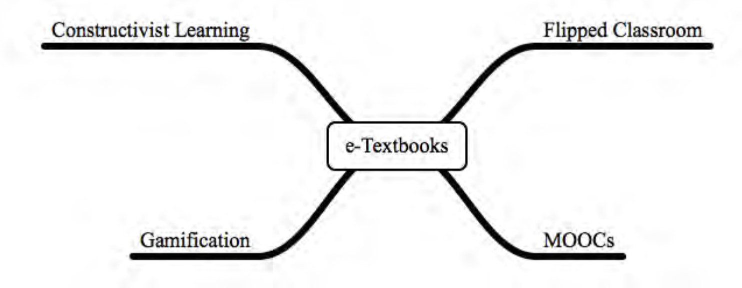

Figure1: Macrosocial educational affordances of etextbooks

Is adoption being thwarted by lecturers remaining conservative? It has been suggested that it is actually the publishers who need to be more innovative in their offerings (Bowker, 2013). While educational publishers continue to offer digital textbooks as little more than digital replicas of a print book, albeit increasingly with companion websites, lecturers will continue to see these e-textbook as having the same function of the printed book. By using them simply as a source of largely textual content, there is no appeal for lecturers to move beyond offering the digital format as an alternate version, and this may impact innovation in pedagogy. While it is agreed that it is lecturers who to a large extent determine which textbooks will be adopted, publishers have a significant role in moving lecturers beyond their current notion of what a digital textbook is by offering innovative digital textbooks which exploit the affordances possible in enhanced digital textbooks. One lecturer sums it up in this remark: *"I feel there is a missed boat somewhere".*

This paper has two broad aims. Firstly, it presents preliminary investigations into this topic. Based on the literature and interviews presented here, the larger study will through an iterative approach further investigate lecturers' attitudes toward digital textbooks. Specifically, Affordance theories and Technological Pedagogical Content Knowledge model (TPACK) (Koehler & Mishra, 2008) will be utilised to analyse lecturers' knowledge and understanding of digital academic textbooks in terms of how they can be integrated into the pedagogy at both micro and macro levels. Students perspectives will also be sought in order to gain a better understanding of the interaction between teachers, students and their (e)textbooks. It is furthermore a call to action for educational publishers to embrace the opportunities available through the affordances of enriching digital textbooks with more sophisticated technologies.

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Where to from here? Reflections, rethinking & reimagining higher education assessment in the New Media Age

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Abstract: The New Media Age has ushered in new opportunities, challenges and demands in the delivery of higher education. Access to information and people anywhere/anytime is transforming traditional education models and changing teaching and learning approaches. In this paper, we reflect on current assessment practices in higher education and consider the impact the New Media Age is likely to have on the future of assessment. Examining education technology trends, we present a model that predicts the expansion of assessment along two dimensions**:** an *involvement* continuum and an *accessibility* continuum. The former consists of a scale *intrapersonal to interpersonal* while the latter consists of a scale *fixed to flexible*. Higher education assessment has traditionally provided for a relatively fixed spatiotemporal accessibility and intrapersonal involvement context. In this paper we suggest that the new media phenomenon will extend assessment provision further into flexible spatial and temporal accessibility, and deeper into interpersonal involvement.

Keywords: Future Assessment, New Media Age.

Introduction

Assessment is a focus and driving force for student achievement and also provides feedback into the teaching process. Innovations in education brought about by new media are having a flow-on effect on the teaching and learning process (Caple & Bogle, 2013), and corresponding transformations in assessment may soon follow. This paper explores the effects that new media is likely to have on assessment in the future. To explore future assessment possibilities, we first reflect on current practices and trends, and then overview soon-to-be mainstream technologies to explore their associated assessment opportunities and challenges. From these we construct a general direction for assessment in the future and discuss implications.

Assessment in the Future

Where are we now?

Current assessment consists of diagnostic, formative, and summative components (Biggs & Tang, 2007). Assessment has traditionally been undertaken in a relatively fixed space and time. It has been regarded as a "monologue" between teacher and student (Nicol, 2010) dominated by submission of assignments and/or closed book examinations and focussing chiefly on assessing recall of content. There remains a pervasiveness of the traditional lecturer view that holds tightly to a fixed, intrapersonal assessment model because this is the only way that the lecturers/institution can "guarantee" that a student's work is truly their own. New media technologies are driving change in teaching and learning but assessment progression still lags behind, and traditional assessment models cannot deal adequately with more collaborative aspects that new media technologies can support (Gray, Thompson, Sheard, Clerehan, & Hamilton, 2010). Potentially, these technologies can create new opportunities for how we assess students: greater emphasis on formative aspects i.e. focus on processes/collaboration/communication and targeting higher order outcomes; greater student engagement/involvement and more choice and flexibility in assessments (Barwell, Moore & Walker, 2011; McNeill, Gosper, & Hedberg, 2010; Scardamalia, Bransford, Kozma, & Quellmalz, 2012).

What is on the Horizon?

Technology is one of the main drivers of assessment change (Johnson, Adams, Cummins, Estrada, Freeman, & Ludgate, 2013; McNeill et al, 2010)**;** therefore it is important to determine the soon-to-be mainstream educational technologies in order to understand their driving influences upon future assessment. The recent internationally recognised Horizon Report Higher Education Edition (Johnson et al, 2013) is a considerable body of work, and in it the potential impacts of nearly 50 emerging technologies have been analysed by an expert advisory board to draw consensus on the six main technologies that show promise of having a wider impact in higher education. These six main technologies, MOOCs (Massively Open Online Courses), tablet computing, games/gamification, learning analytics, 3D printing, and wearable technology are briefly described within the context of assessment.

MOOCs are commonly assessed via automated quizzes, although peer review systems, student gurus, badges and other forms of assessment are currently being explored with no real verdict as yet to which is most effective. ***Tablet computing*** is portable and facilitates sharing content with ease, and therefore ideal for collaborative exercises among students at various locations. ***Games*** increase soft skills including problem-solving and teamwork by leveraging motivations from content and context immersion. ***Gamification***, on the other hand, incorporates comparatively malleable elements of games such as levels, badges, quests and rewards, and allows freedom in choosing assignments. ***Learning analytics***, originally focused towards early warning signals for retention, is now directed towards gaining insights into student interactions. ***3D printing*** allows non-collocated groups of students to create physical items and submit "blueprints" electronically to be "printed" into physical form for assessment. ***Wearable technology***, in addition to being fashionable, allows for convenient access to information and people anywhere/anytime, and are likely to automate location-based decision-making.

Why should we assess differently?

The six technologies likely to become mainstream described above include a mix of mobility, innovation and collaborative opportunities. For instance, learning analytics provides decision-making information originally focusing on individual retention issues but more recently focusing on interaction analysis. Tablets and wearable technology are devices allowing mobility and sharing yet can be equally utilised independently within a class environment. While MOOCs largely contain individually assigned automated quizzes, there has been an exploration of including more collaborative elements. Games and gamification, which potentially can make learning more engaging, can be adopted either in class and/or online. Although most of the technologies themselves do not mandate any specific assessment models, a number of constraints and concessions exist. For example, while MOOCs require computer automated and/or peer involvement due to their potential massive student numbers, they allow flexible automated assessment times to allow students to move at their own pace.

The affordance of the six technologies discussed appears to be their ability to automate testing and feedback and/or their ability to facilitate collaborative assignments. Automated testing and feedback allows for more flexible place and time assessment accessibility. Collaboration allows for greater interpersonal involvement within the assessment process. Based upon these continuums we derive a model that describes possible assessment directions, and their relationship to traditional assessment practices. This model helps us to reflect upon the nature of the nature of technology-enabled assignment tasks and the suitability of the corresponding assessment applied.

Please note that in the figure below the accessibility continuum consists both of spatial and temporal flexibility; these are collated for convenience and do not necessarily indicate correlation.

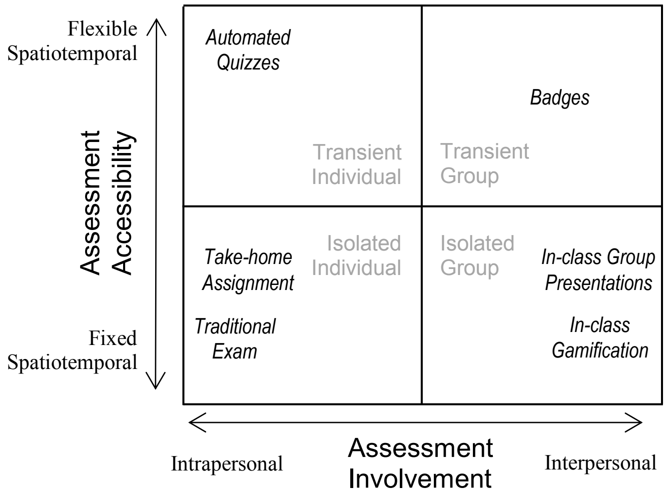

Figure 17 - Assessment in the New Media Age

Discussion

The six educational technologies tipped by the 2013 Horizon Report to become mainstream have provided indications of continuing directions towards *interpersonal involvement* (e.g.: collaborative learning) on the one hand, and *flexible spatiotemporal accessibility* (e.g.: independent anywhere/anytime learning) on the other. Interpersonal involvement in assessment such as collaborative learning supported by new media cannot be assessed to full effect using previous strategies (Gray et al, 2010; Waycott, Gray, Thompson, Sheard, Clerehan, Richardson, & Hamilton, 2010). This is because new media differs from traditional forms of assessment by enabling compilation and sharing of resources and establishing interrelated knowledge networks (McNeill et al, 2010). Assessment activities of interactive learning in an online environment can therefore differ substantially from what staff and students are familiar with (Waycott et al, 2010), and there is greater potential to support the assessment of higher order learning processes (McNeill et al, 2012). Conversely, automated testing for *independent learning* is simpler to deploy and offers great efficiencies for academics. It can be expected that students will gain more from automated feedback than is commensurate with the effort that goes into producing it (Sadler, 2010); however this form of assessment is often criticised for primarily targeting lower order skills (McNeill et al, 2010).

The two expanding assessment continuums of involvement and accessibility offer different challenges with respect to modifying traditional assessment practices accordingly. Given current new media trends, it is foreseeable that flexible accessibility and interpersonal involvement learning processes will converge in the mainstream, and therefore new or more mature corresponding assessment strategies are likely to follow. The dual effect that new media is having on accessibility and involvement may be the impetus that leads to a rethinking and reimagining of assessment practices in higher education. Traditional assessment practices are already being challenged by new media technologies in a number of ways. For example, a recent framework (Cochrane & Bateman, 2009) that links new media mobility to associated pedagogy, andragogy, and heutagogy suggests varying forms of assessment should be applied to differing media usage. Motivational constructs based on fundamental human desires such as reward, achievement, status and altruism are leveraged for learning via gamification (de Byl, 2012), integrating assessment via digital badges. Sadler (2009) recommends increased student autonomy and involvement equipping them with ability to assess and evaluate their peers in a holistic manner. Gray et al (2010) consider that traditional linear principles of constructive alignment and pre-determined objectives may give way to a more responsive assessment, although also considers that student Web 2.0 authoring will not totally replace other assessment strategies. The model presented in this paper also suggests a pluralistic approach to assessment in the future, with new assessment strategies coexisting with traditional practices.

Implications

One major implication of a pluralistic assessment model is based on variable accessibility and involvement is the issue of appropriately aligning assessment to the learning process. Pelliccione & Dixon (2008) report that much of the recent research into assessment procedures in higher education asserts a need to align assessment strategies to complex learning patterns. Inappropriately designed assessment in a Web 2.0 context could have a deleterious effect on student learning and engagement, and an academic without a sound rationale for assessing students' Web 2.0 activities will struggle to justify the added effort flowing from the assessment (Gray et al, 2010). Therefore, simply applying a familiar traditional assessment model to a 'variable accessibility' or 'interpersonal involvement' learning process will constitute a misalignment, will likely result in a dysfunctional measure of knowledge achieved, and may even foster negative student motivations for learning.

Another significant issue of the pluralistic assessment model is academic integrity. Gray et al (2010) assert that new media does not automatically create transparency and accountability. The question of reliable assessment of knowledge exists because automated online tests are not commonly invigilated, and the continuous and dialogic texts produced via social web technologies may lead to questions of academic authorship and integrity that university students are required to demonstrate (Waycott et al, 2010). A future focus away from the acquisition of predetermined knowledge and towards learner engagement creates a greater need to capture the process of student learning (Barwell et al, 2011; McNeill et al, 2010), suggesting a greater emphasis on assessment for learning with a need to embed integrity assurance into the process.

Limitations

This paper considers the future of assessment purely within a technological context, and therefore does not consider economic, institutional, political or bureaucratic influences. Only the most recent Horizon Report was referred to in this paper as a representative of future technologies; perhaps a wider review of predicted technologies would produce a more comprehensive analysis of future assessment needs.

Conclusion

This paper considers the effect that the New Media Age is likely to have upon the future of assessment in higher education based upon six soon-to-be mainstream technologies identified in the recent Horizon Report. A reflection of current assessment practices and trends suggests that educational technology precedes assessment, and that an expansion of the traditional assessment model is occurring. Educational technologies on the horizon indicate a further drive in the directions of flexible assessment accessibility and interpersonal assessment involvement. Future assessment directions introduce greater challenges relating to appropriate alignment of assessment and learning process, and to issues of ensuring academic integrity, and within this context will require a rethinking and reimagining of how to assess and evaluate learning in the future.

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Cross-institutional development of an online open course for educators: confronting current challenges and imagining future possibilities

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The Global Dimensions in Higher Education module is a fully online open course for educators, jointly developed by three UK universities through a process of consultation and inquiry involving colleagues within the global education sector. The purpose of the module is two-fold. Firstly, to engage academics within and beyond the partner institutions in a critical exploration of transnational and global issues within higher education. Secondly, to provide the project partners with an opportunity to understand and address the challenges of jointly developing and delivering an online course that is to be offered both openly as well as integrated within credit-bearing and continued professional development provision for academics in the partner institutions. This short paper describes progress to date in developing the Global Dimensions in Higher Education module, our current activity focused on validating and implementing the module, and lessons learned to be considered for the collaborative development of open online courses.

Keywords: Online learning, open educational practice, cross-institutional collaboration, academic development, globalisation and internationalisation of higher education

Context for development

The Higher Education sector in the UK and internationally is in a tumultuous period of change, and we see in current debates the need to collectively explore and critique the current state of HE and to rethink the values that inform the educational opportunities provided to our students. Much of the current debate is focused around the internationalisation and globalisation of higher education, and what this might mean for our educational practices, our institutions and the sector. Interestingly while individual institutions are seeking to strengthen their own profile and position within the global HE sector (of which the current MOOC phenomena is a pertinent example), there is a growing recognition and strong governmental direction being given to the importance of institutions working together to meet the needs of current and future learners. Within the UK this has been the focus of both the Collaborate to Compete report of the Online Learning Task Force (2011) established by the Higher Education Funding Council for England, and of the recent Report of the Review of Higher Education Governance in Scotland (Von Prondzynski, 2012).

Recognising both the need to engage academics in exploring and critiquing current developments in the HE sector, and the opportunities offered by cross-institutional collaboration, Aston University, Edinburgh Napier University, and the University of Dundee have been developing over the last year a new online postgraduate module focused on Global Dimensions in Higher Education (GD in HE). Encouraged by other recent work in the area of online academic development (e.g. Nerantzi; 2011; Gruszczynska et al, 2012), the view being taken is that an online postgraduate module - one that could be used in learning and teaching qualifications and related staff development provision - presents an ideal vehicle for engaging academics (including the next generation of academic leaders) in thinking critically about HE as a sector, how it is likely to change, and how our institutions can remain relevant nationally and internationally. We also believe that by being delivered online, the GD in HE module can offer academics from a range of institutions nationally and internationally a structured and focused online opportunity to engage collaboratively that would otherwise prove very difficult to provide.

Progress to date

The development of the GD in HE module has been partially funded by the HEA/JISC OER Project as part of Phase 3 (Promoting UK OER Internationally). As an OER the module will first be made available as an open course when it is piloted, and following evaluation and refinement will then be made available to the sector as an OER that can be used to extend postgraduate provision for academics.

From a pedagogical design perspective, the GD in HE module is being developed as a fully online collaborative module comprising the four units illustrated in Figure 1, and featuring a range of digital artefacts (video interviews, podcasts, interactive case studies, digitised texts) and activity descriptors that will support critical engagement with the themes of the module. At the time of writing the development of the module is nearing completion, and will be piloted as an open online course during the academic year 2013/14.

Figure 18. Interactive mapping of GD in HE module content
http://globaldimensionsinhe.wordpress.com/module-map/

As regards developing the content of the GD in HE module, and ensuring the integrity and relevance of this within an international context, an educational action research approach has allowed the development of the module to take place within a framework of public and reflective inquiry (Cousin, 2009).

This process has involved project members, and potential international partners and contributors, in a range of reflective activities and joint dialogue including: the development of a project blog where project members and colleagues in the wider academic community have contributed views and material relating to the themes and content of the module (http://globaldimensionsinhe.wordpress.com/); reflective logs that have allowed the project team members to document their own self-reflective enquiry; and the development of a case study for the Higher Education Academy to provide interested parties in the HE sector with a better understanding of the challenges and benefits of collaboratively developing joint online provision (Wheeler et al, 2013).

We have carried this ‘co-produced’ approach (Fenwick, 2012) to the module’s development as an OER forward in several other ways, including through gathering an extensive series of ‘Global Stories’ that feature academics in the international community providing their view on relevant global issues and dimensions in higher education . These global stories feature on the project blog (http://globaldimensionsinhe.wordpress.com/global-stories/) but will also form an important part of the course materials for the module.

Ultimately the GD in HE module is being designed to move participants from a general exploration of key themes and issues through to increasingly exploring them in the context of their own institution, and the context of their own departmental or individual professional practice. The structure of the module, and the progressive nature of activities across the four units, is based on a design framework for technology-enhanced learning that has been successfully applied in postgraduate academic development programmes within two of the partner institutions (Smyth and Bruce, 2012). In terms of delivery, the approach to the facilitation of asynchronous and synchronous activities is being guided by a framework for online student-directed learning (Vlachopoulos and Cowan, 2010) developed by one of the project team and also successfully implemented in various contexts.

Implementation challenges

The action research and development work undertaken to date for the GD in HE module has led to a number of insights and lessons learned for the project team. Regarding the extent to which OERs can be harnessed and integrated in systems and cultures that were not directly involved in the design and the development process, there have been a number of particularly important lessons learned. One is around the need to address our own assumptions about the extent to which OERs as a concept are understood within the international academic community that GD in HE is being developed for. For example, a contingent of colleagues from Tyumen State University in Siberia, who visited one of the project partners for discussions, were not aware of what OERs were or the open access and potential for repurposing they afforded. Our discussions with other potential institutional partners and module participants have also highlighted possible situations within which staff at overseas universities out with the UK may have limited access to technology for participating in the module. Another critically important issue lies in the extent to which the content and activities of the module itself can provide a balanced, non-parochial set of resources for exploring global dimensions in higher education that is free of bias or culturally-informed assumptions. The extent to which this can even be possible is debatable, but it is an ideal to strive for. Within the GD in HE project blog the project team have addressed 'divisive practices' in globalised education provision, including the 'cultural imperialism' that McBurnie and Ziguras (2009) warn against and within which the offering of programmes informed by other cultural norms and perspectives may undermine important national beliefs and norms relating to education. This is an issue that has also been brought into sharp focus by Professor Kuan-Hsing Chen from the Institute for Social Research and Cultural Studies at Chiao Tung University, Taiwan, who in a podcast produced for the GD in HE module addressed the extent to which Western approaches to international higher education can be highly imperialistic in nature.

A critical question going forward then, in both piloting the GD in HE module and in making it available as an OER module to support staff development relating to global issues in HE, is to ask how can we meaningfully internationalise academic development provision through an open online module?

There are also a number of practical challenges in implementing the module that the project team are currently tackling, and which relate to or have arisen from our desire to develop and deliver the GD in HE module as a truly joint online education initiative. The main implementation challenges include:

- Joint approval of the module, so that it can be offered as a jointly delivered open course and also subsequently integrated within our institutional teaching certificate programmes. The risk of not jointly validating collaborative provision of this kind is that each partner may end with a slightly different version of the module based on the recommendations from their own validation panels
- Potential need to restructure institutional policy and regulations to accommodate collaborative online course design and delivery. The three partner institutions all run 20 credit modular systems, so there is already an alignment in notional hours of delivery and levels of activity that would otherwise need to be addressed. However we are aware that the challenge of aligning credit levels, length of trimesters, and expected hours of teaching and learning activity would normally be a significant one.
- Enrolment and assessment of open access versus institutional participants, particularly concerning how open access participants who do not belong to any of the partner institutions can be formally enrolled on the module and subsequently be formally assessed and receive the same volume of postgraduate credit as participants who happen to also be staff at one of the partner institutions.
- Access to licensed resources from across the institutions, as the intention is to try and allow all participants on the module to access online texts (e.g. e-books) from across the partners institutions
- Integration of open platforms of delivery with institutional educational technologies, so that we can

blend a neutral, non-institutional platform for course delivery (e.g. Wordpress, Google groups etc) with other educational technologies from the partner institutions (e.g. virtual classroom tools).

- Distribution of developmental costs and administrative costs and support

Looking forward

The project team are optimistic about the first run of the GD in HE module as an open course during the academic year 2013/14, and are encouraged by the levels of interest in the module from potential participants, participating institutions, and colleagues from the academic community who have contributed materials or offered their input as facilitators. We are also optimistic about tackling the aforementioned implementation challenges, and finding solutions to them. Our view is that truly joined-up, truly collaborative development of credit-bearing cross-institutional online courses is currently limited by the constraints that institutional policies, practices and systems place on innovative partnership working in the area of curriculum development. As we continue to address these constraints in the final stages of our work on the GD in HE module, we hope that we will have further lessons learned to share with colleagues considering similar ventures.

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Mobile devices for learning in Malaysia: Then and now

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Since 2010, there has been a visible increase in the amount of research focused on mobile learning in higher education in Malaysia. To determine if this increase corresponds to an increase in the use of mobile devices to support student learning, data from two surveys conducted in 2008 and 2013 were compared to determine the changes in rates of ownership and use of mobile devices among students. In 2008, although all students owned feature phones very few had access to other mobile devices and rarely used them to support their learning. In 2013, the picture had changed significantly, with some 80 per cent of students owning smart phones and all had access to mobile devices of some sort. Additionally, students were using these devices to support their learning in a number of ways. The paper concludes with indications and implications for future research.

Keywords: Mobile learning, m-learning, mobile learning research, Malaysia

Introduction

One of Malaysia's prominent online news portals published an article reporting that almost 40 per cent of Malaysia's population owns at least two mobile phones with a penetration rate of some 137.7 per cent (NST-Business Times, 2013). The same article also reported that based on trends revealed in a recent survey conducted by McCann Worldgroup, within two years almost 60 per cent of the Malaysian population will own a smartphone. Malaysians were also found to be among the most prolific users of their smartphones, spending an average of 6.4 hours a week accessing the internet through their devices (NST-Business Times, 2013). These statistics confirm that being mobile and connected is very much part of being Malaysian. Naturally, this phenomenon has also influenced the teaching and learning environment. All indications are that mobile learning will strongly impact Malaysian higher education. This is evidenced by the increase in research activities and initiatives in the area of mobile learning, particularly in the public and private universities. Other affirmative developments include the formation of the Mobile Learning Association of Malaysia (MLAM), which was officially registered on 21 January 2011; as well as the first 1st International Conference on Mobile Learning, Application and Services (mobilcase2012) that was held in September 2012.

Mobile learning research has been steadily increasing in Malaysia, though the deployment of mobile learning in higher education courses and programs has not been widespread due to several factors (Embi & Nordin 2013). The rapid growth in the smartphone industry in the last few years may precipitate a change. Smart mobile devices are notably becoming more accessible, affordable and widely used. This paper will chart the wave of change by first exploring the mobile learning research landscape in Malaysia and then explore how Malaysian higher education students are using mobile technologies for learning by comparing two different cohorts of a Malaysian private university separated by five years. The first study was conducted in mid-2008 and another was conducted earlier this year to map how usage patterns of mobile devices for learning are changing.

The rise of mobile learning research in Malaysia

In line with the rest of the world, research focused around the use of mobile devices for learning and teaching is gradually gaining prominence in Malaysia. There are several significant research groups in the Malaysian higher education sector that are actively investigating mobile learning. A research team led by Professor Dr Mohamed Amin Embi and Dr Norazah Mohd Nordin at the National University of Malaysia researches and publishes extensively on mobile learning. Professor Embi is also the president of the MLAM. A recent publication entitled "Mobile learning: Malaysian initiatives and research findings", is a collaborative effort from the National University of Malaysia and the Ministry of Higher Education, Malaysia (Embi & Nordin, 2013). The recent research focus for the team has been around the level of readiness for mobile learning of both teachers and students (Hamat, Embi & Hassan, 2013; Arif, Yazi, Radzi, Husin & Embi, 2013).

Another research team is based at the Faculty of Creative Multimedia, Multimedia University, Malaysia. Dr Koo Ah Choo leads the team as the chairperson of the Ubiq Similar Interest Group (formerly known as Mobile and Ubiquitous Learning) that actively conducts research related to mobile learning. Recent research studies include utilizing mobile devices for maths and science (Atan, Koo & Harji, 2010; Koo, Atan, Harji, Kiluwasha & Song, 2012), economic perspectives of mobile learning (Poon & Koo, 2010) and mobile interactions within the special needs community (Song & Anuar, 2010; Song, 2012). Another notable research team is from Open University, Malaysia. Led by Professor Dr Zoraiti Wati Abas, researchers from the Open University extensively research how mobile learning operates and functions in the open and distance learning environment (Abas, Lim & Mohamad, 2010; Abad, Lim & Ramli, 2011; Peng, Abas, Goolamally, Yusoff & Singh, 2011; Lim & Ramly, 2011; Lim, Abas & Fadzil, 2011; Lim, Fadzil, & Mansor, 2011).

Based in Penang, Professor Rozhan M. Idrus and his team from the Universiti Sains Malaysia are concerned with the functionality of mobile technologies and services in distance education (Idrus, 2013; Ismail, Gunasegaran, Koh & Idrus, 2010; Ismail, Idrus, Ziden & Rosli, 2010; Ramli, Ismail, & Idrus 2010). Researchers from the Universiti Teknikal Malaysia Melaka have also contributed to this area of research with studies on mobile pedagogical agents and web-based mobile-supported learning management systems (Salam, Hameed, & Bakar, 2013; Salam, Makina & Bakar, 2013). Other areas of mobile learning research are focused around studies of user perception (Tan, Ng & Lee, 2013; Rahamat, Shah, Puteh, Karim, Din, Aziz & Mahamod, 2013) and local cultural perspectives with respect to mobile learning (Arrifin, 2011; Ariffin & Dyson, 2012).

Though there has been a marked increase in research activity around mobile learning in Malaysia since 2010, it wasn't clear if this was reflected in rates of adoption of mobile learning initiatives in higher education or whether students accessed mobile technologies informally for their learning. In order to determine if this was the case, results from a survey mapping students' use of mobile devices for learning from 2008 was compared and contrasted to the results obtained from another survey conducted second quarter of this year.

A Malaysian private university's perspective: then and now

Back in 2008, a group of researchers from a Malaysian private university conducted a survey with a large cohort of first year undergraduate Creative Multimedia students (n=270). The aim of the survey was to find out how students were using both their mobile and non-mobile devices for learning (Yuen, Song & Jong, 2008). The students ranged in age from 17 to 26 with 130 male students (56 per cent) and 101 female students (44 per cent) represented in the study. In this study, all students owned 2G or 3G feature phones, favouring Nokia or Sony-Ericsson phones. The majority of students (74 per cent) owned a desktop computer and 54 per cent owned a laptop computer. About a quarter of students (26 per cent) owned both a desktop computer and a portable laptop. Very few students owned a personal digital assistant (PDA) or portable handheld PC (2.6 per cent), but a large number of students (41.1 per cent) owned an iPod, MP3 or MP4 player.

The study conducted in 2008 asked students about the frequency of their use of digital devices for seeking information and news, particularly related to e-learning, references, seeking general information and for leisure (Yuen et al.) on a five point scale (1; Always, 2; Frequently, 3; Occasionally, 4; Seldom and 5; Never). The study found that a large proportion of students used non-mobile devices for accessing the university's Learning Management System (LMS) and for e-learning (M=3.27. SD =1.14), searching of reference databases (M=3.98. SD =1.04) and general information searches (M=3.42. SD =1.14). The use of mobile devices to support learning was less frequent and students mostly used mobile devices for entertainment, leisure and social purposes. The use of mobile technologies to access the LMS and for e-learning (M=1.4. SD =0.95), searching of reference databases (M=1.55. SD =1.03) and general information searches (M=1.82. SD =1.099) was low.

A follow up study was carried out with a similar cohort of first year undergraduate Creative Multimedia students from the same private university but five years later, from May to June 2013. The aim of the study was to identify the types of mobile technologies owned by Malaysian students and whether these devices were being used to support learning. An online survey tool was developed and an email invitation was sent to all first year students enrolled at the university. The project was undertaken as part of a larger project to inform the development of a Mobile Learning Evaluation Framework in higher education (Murphy & Farley, 2012). The aim of the larger project is to develop a framework to facilitate the implementation of mobile learning within a range of higher education contexts.

Preliminary research findings on follow-up study

Responses were received from 200 students with the sample consisting of 114 (57 per cent) female participants and 86 (43 per cent) male participants; ranging in age from 19 to 43 with a mean age of 20. Students resided mostly with housemates or friends (81, 41 per cent) or in a residential college (43, 22 per cent). Some also resided in single accommodation off campus (31, 16 per cent) or with family or parents (30, 15 per cent). Some were living with a partner or children (7, 4 per cent). Participants spent a minimum of 5 hours and a maximum of 70 hours per week studying (M=28.90, SD=23.04). A few were employed in addition to studying (17, 9 per cent) and worked a minimum of 5 hours and a maximum of 48 hours a week.

Although the age and gender profiles of students in the 2008 study were similar to the present cohort, the levels of ownership of mobile technologies and other ICTs had changed drastically over the 5-year period. Nearly all students (except for 2) owned a mobile phone, yet smartphone ownership (81 per cent) greatly exceeded ownership of feature phones (43 per cent) (See Table 1). The number of students who owned a desktop computer had decreased to only 31 per cent and laptop ownership had risen to 92 per cent. Few students owned a tablet computer (19 per cent) yet 48 per cent had access to one for use. Net book computers (10 per cent) and eBook readers (4 per cent) were not owned by many students. A number of students owned multiple technologies with students owning a minimum of 1 and a maximum of 8 technologies (M=4.86, SD =1.69). These two surveys also demonstrated how mobile technologies can appear while others disappear. For example, PDAs were present in the 2008 survey but had since completely disappeared; while tablets such as iPads have appeared over that same period.

Table 1: Percentage of students who own or have access to mobile technologies and other ICTs

	2008*	2013	
	Ownership	Usage (but not ownership)	Now ownership or access
Standard mobile phone	100	15.5	41.5
Smartphone	n.a.	13.5	6.0
MP3 player	41.1	15.5	45.0
Laptop	25.5	4.0	4.0
Desktop computer	48.5	38.5	31.0
E-book reader	n.a.	10.0	86.0
Tablet computer	n.a.	48.0	33.0
Netbook	n.a.	23.0	67.5
PDA	2.6	n.a	n.a

*The data from 2008 adopted from (Yuen, Song & Jong, 2008).

Students were requested to indicate which of the technologies that they owned or used were used to support learning. The laptop computer was used by nearly all students who had them to support their studies (95 per cent) and surprisingly 76 per cent of students who owned smartphones used them for learning activities. This is a drastic change from the previous study in 2008, which found that the usage of mobile devices for learning purposes were very low. The desktop computer was the only other technology used extensively for learning by those who owned them (54 per cent) and adoption of tablet computers (34 per cent) for learning activities was relatively low. Smartphones were mostly used for taking photos and videos to support learning (91 per cent), communicating on social media sites (79 per cent), taking notes (77 per cent) and sharing information with other students (74 per cent). Students also used smartphones for sending and receiving emails from course leaders or peers (61 per cent), accessing or reading course materials (57 per cent) and searching the internet for course related information (55 per cent). A third (34 per cent) of the students who owned smartphones used them for accessing the university's LMS.

Conclusion

Since 2010, research into mobile learning is becoming increasingly significant on the e-learning landscape in Malaysia. Though there are a number of mobile learning initiatives in higher education (Issham, Idrus et al. 2010), the adoption of mobile learning in higher education in this territory is not widespread. Even so, ownership of mobile devices is increasing rapidly in line with the rest of the world. The extent to which mobile device ownership is increasing among university students is evidenced by the two surveys done with similar cohorts of students at a Malaysian private university five years apart, in 2008 and 2013. In 2008, though all students owned mobile phones, none of these were smartphones and were used infrequently to support learning. In the 2013 survey, the types of devices owned by students had shifted considerably with some 80 per cent of students owning smartphones. All students surveyed owned or had access to at least one mobile device. Additionally, these devices were often used to support learning. The activities that these students engaged in were not formally planned in the context of courses and programs i.e. they were not formal learning *per se*, but instead supported formal learning activities.

It would seem that the increased research activity focused around mobile learning in higher education in Malaysia does correspond to an increasing use of mobile devices for learning by students. To determine if these trends are more widespread among Malaysian higher education students, additional surveys will also be deployed by the authors in other universities and tertiary institutions. Similar surveys will also be deployed in Vietnam, Thailand and China in order to determine if these trends are evident in other Asian countries. A thorough understanding of how students are already using their mobile devices to support learning could lead to the more effective and sustainable deployment of mobile learning initiatives across the sector.

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Metamorphosis and Adaptive Digital Publishing

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This paper aims to explore the conceptual work being undertaken at Charles Sturt University to develop The Adaptive Digital Publishing Engine (TADPOLE). The aim of the project is to envision a distinct way of creating, structuring and publishing educational resources for delivery to a wide variety of platforms and media. The development of TADPOLE will allow us explore a 21st century approach to publishing that embraces digital affordances and uses metamorphosis, rather than translation or transcription, to convert content from one format to another.

Keywords: adaptive digital publishing, digital publishing, adaptive media, mobile

Understanding the Present

There has been a dramatic uptake in mobile devices since their introduction. From 2011 to 2012 the number of Australians with smartphones rose from 25% to 49% (ACMA, 2013). This has opened up avenues and opportunities to publish content on new platforms and take advantage of digital tools that embed rich media and interactivity. During 2012 the mLearn Project at Charles Sturt University (CSU) undertook an investigation into transitioning and developing educational resources for mobile devices.

The project found that whilst some resources had been professionally developed and optimised for the modern era, many were compromised by legacy software, content lock-in and the attachment of proprietary code and formatting to content due to ad hoc development processes. This severely hampered the process of adapting this content for delivery across a wide variety of mobile devices and platforms.

The many different types of content across diverse subject matter and discipline areas at CSU adds a further level of complexity to adapting existing content for the mobile realm. To cater for this diversity there is often a need for bespoke and customised solutions, which require exemptions from standardising processes, content and authoring workflows.

The most crucial observation from the project was that the current state of our systems, processes and software are tied to an analogue way of thinking, developing and working. The current methodology places emphasis on the output of an artefact, with little regard shown for the process of creation and development. There is nothing inherently wrong with this model, it works in the singular context and output to which it is applied, but we have learnt through our exploration that we have reached the limit of this process because there is no longer a single context. The need to publish for print *and* web *and* eBook breaks the current model, and with a proliferation of devices, formats, operating systems and standards now abundant, the future is multi-contextual.

A solution to the multi-contextual future that the mobile culture heralds, requires not a 'one size fits all' approach, but a way of creating content that is adaptive to many possible endpoints – print, web, app, eBook. This solution would also need to emphasize creativity and adaptability in the creation and development of content, rather than focus solely on its output. This solution must adopt and build on the concept of "Create Once, Publish Everywhere" (Jacobson, 2009), devised as part of the National Public Radio's content management strategy. This offers a better way forward.

Imagining the Future

Content has traditionally been directly linked to presentation – books were developed to be printed, web pages for web sites, video for TV. However, new digital formats and devices are challenging that behaviour. Tablets and smartphones blur that line, as they are able to present content from the printed page, access the web and deliver video. Tablets and smartphones also offer new ways of presenting and creating experiences as well as new ways of interacting with content such as touch and gestures. Given the diversity of technology there is also a need to consider how we provide a consistent user experience. If we want to cater for this model of the future we need to ensure that content flows like water, changing its shape to match every presentation channel to enable use across a broad ecosystem (Weston, 2012).

Starting with Digital

The essential problem we need to deal with is that analogue systems and processes have been shoehorned into digital spaces. We need something new which accepts that content today is primarily created, authored, edited, produced and published in the digital space. We must work within a purely digital environment, which requires "a shift away from artefact, and back to essence" (Gemmell, 2013) and co-opts the essential benefits of the digital space.

The first uniquely digital concept is that of metadata. It allows us to create structure, define subjects, formulate messages and construct relationships in a way that is embedded within the content itself. It allows us to develop a structured authoring process, which engenders a sense of purpose for the content.

The second concept builds on structured content so that it can be authored *within* the database. This adopts the process that evolved from the web where we replace the artefact, the static HTML page, with the essence, "dynamically pulling out the content you want and rendering it in a view" (Johnson, 2013). The traditional print publishing process has only ever utilised databases for storage of the finished artefact. While web publishing has adopted the database into the Content Management System, it is rarely used to its full potential or used beyond the web, for content that is complex or for rich media. Incorporating the database into the authoring environment allows the power of logic to be utilised to construct and publish to a variety of endpoints dynamically, shifting when transformation occurs to the publishing point rather than at the point of creation so that COPE (Create Once Publish Everywhere) can become a reality.

TADPOLE

The aim of TADPOLE is to develop a new type of system that is neutral to the delivery channel and where content and narrative provide shape and form rather than artefacts. By instilling a Content First (Keith, 2011) approach to publishing and employing metamorphosis rather than traditional methods of translation or transcription we have conceived The Adaptive Digital Publishing Engine.

Metamorphosis is an evolutionary model where there is conspicuous and abrupt transformation accompanied by changes in habitat or behaviour (Britton, 2009). This corresponds directly to the current disruption and changes that technology, in particular mobile technology, has heralded in our culture. The environment isn't changing, it's changed already, "User behaviour always evolves much faster than companies can keep up" (McGrane, 2012) and this is where we find ourselves in Higher Education. Our students and teachers have made significant changes to their behaviour around the consumption of content and the habitat where they do this. They are increasing their consumption of rich media, such as video and audio, while moving away from traditional delivery models, paper books and desktop computers. Applying metamorphosis to the publishing process allows us to create specialised content adapted specifically to this new environment.

What TADPOLE will attempt to do is dramatically re-form and re-shape content to suit different contexts. This process will capitalise on the affordances of a digital environment that lacks any physical restrictions. Rather than simply transcribe content from one format or file type to another, it capitalises on the inherent logic in the machine, to process and metamorphose content and adapt it to various media, devices and contexts in a specialised form.

By fully leveraging the database and metadata information captured during authoring, we develop a highly adaptive publishing system that can change in an agile manner. This eliminates the need to re-create, re-encode, or translate content into many different formats, allowing automation of the publishing process based on structure and logic patterns.

Basic Principles

To do this we need to:

- Separate content from presentation. Stripping away the limits of context frees content so that it can be viewed as liquid and presentation as multifaceted rather than single purpose.
- Separate requirements for authoring and publishing. The authoring needs to be simple and intuitive while publishing needs to be extensible as new and unpredictable environments, formats and behaviours emerge.
- Think Beyond Text and acknowledge that media plays a more significant role and is inherently more complex than copy.
- Accommodate the diversity of content and subjects by supporting a comprehensive collection of possible media elements and the ability to add new and emerging media.

Introducing Adaptive Media Elements

Traditionally the publishing endpoint has dictated the authoring process, but TADPOLE flips this around and treats the content as primary, and the publication channel as an important, but less inherent component, changeable and ultimately disposable. The innovative component of TADPOLE is how the database is embedded into the authoring and creation process. We have developed the concept of the Adaptive Media Element (AME). The AME is in essence a meta-object made up of self-contained referential information. An AME is not a single file per-se, but a container for more detailed and expressive metadata that logic can be applied to. An AME allows this related information and media to be flexibly incorporated into the narrative structure and presented suitably for each endpoint. For example an AME might contain a reference to the type of media, a file itself, a web link to external storage or library, source information for where it came from, reference information, alternative files and metadata like a title, caption and description (see Figure 1).

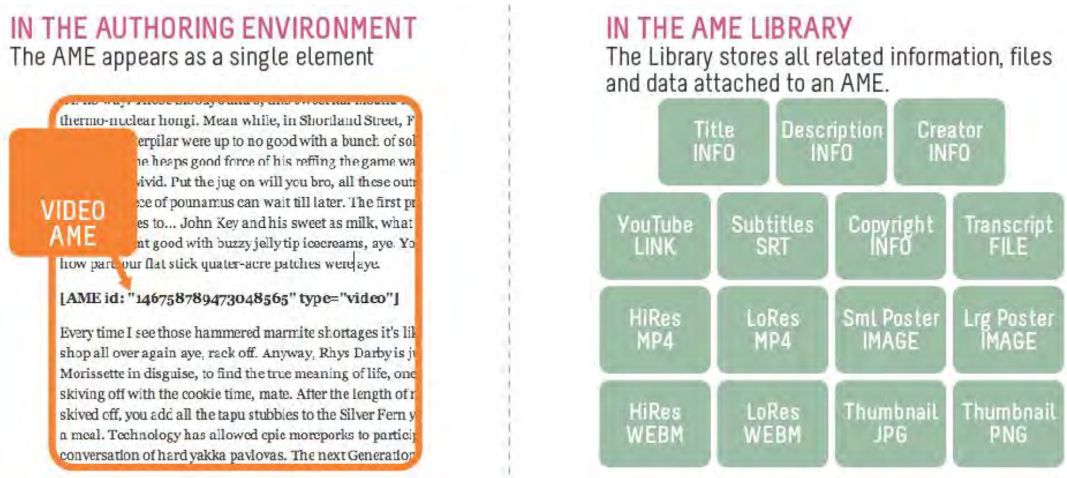

Figure 1: An example of a Video Adaptive Media Element.

As far as the authoring environment is concerned it is treated as a single object, inserted into the context of the narrative. It is only when published that the logic transforms the AME to suit the selected delivery channel. When a resource is published the relevant workflow chooses the most appropriate components to insert. So for a print PDF it wouldn't insert a video, instead it would include an image and a link to YouTube. An eBook may embed the actual file so that it can be downloaded as a self contained artefact and a HTML5 version could include an embedded file or a link depending on how it was to be delivered - offline, online, public or private.

The AME is a customisable concept that can be applied to virtually any kind of content and for any application. From media to different versions of a text, interactive elements to data displayed in different forms, the AME allows the TADPOLE to be tailored and modelled to support diversity of content and provide the narrative with a supportive and 'chunked' structure (McGrane, 2013).

Imagining the System

The concept we have put together for what TADPOLE would look like includes three key components:

1. The Authoring Environment - A simple and intuitive HTML5 mark-up structure
2. The AME Library - A form based application of a database accessible in the Authoring Environment.
3. The Metamorphosis Engine - The process that applies logic to develop the base resource and add the

presentation layer

How it Works

The Authoring Environment would map the functionality already available in a web based Content Management System. This would allow development of separate documents and ways of imposing structure for those components. The AME Library would be a customisable database that would map to the requirements of each type of AME required e.g. Video, Data, Images, and Audio. Once the resource has been authored and is ready to publish the user will initiate the Metamorphosis Engine. This will call on developed profiles for each output type that the user has selected and then parse the resources and apply logic to each AME to create a base resource. The base resource is then sent through the metamorphosis process where it is combined with a presentation template and the final files are produced (see Figure 2).

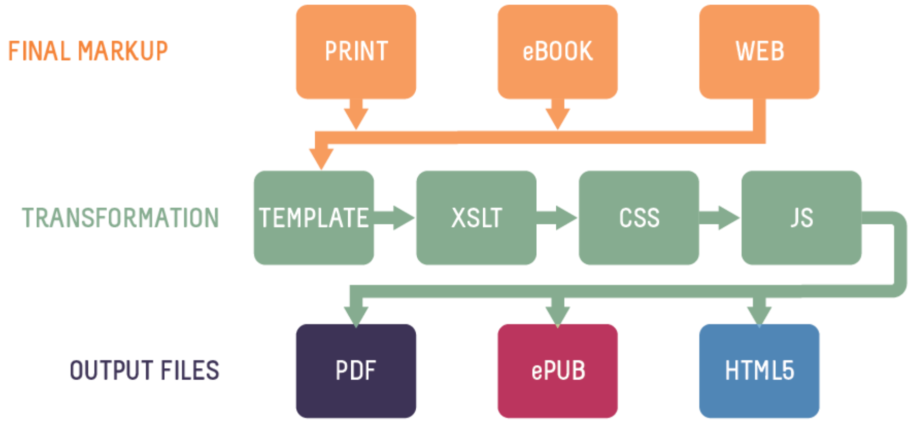

Figure 2: Once the final markup file is developed the relevant template and presentation elements are added and the finished file(s) produced.

Expected Outcomes

The project aims to develop a functional prototype of the system with custom Adaptive Media Elements and output options developed specifically for use at CSU. The system is aimed at complementing our existing LMS, CMS and Digital Repository. It will not host or serve the finished files and artefacts; instead it is focussed purely on the creation and publishing process. The initial output types are expected to be PDF, ePub and web published HTML.

Conclusion

TADPOLE is an attempt to imagine the future of content, how we author it and how we will publish it. This project aims to provide a tangible way to reduce silos and consolidate disparate production processes to provide greater efficiencies and improve the experience of creating and developing content. It demonstrates a way to future proof our institutions ability to publish content by supporting flexibility and ensure that our students benefit from enhanced technologies. Our aim is to ensure that publishing is not static, but a dynamic art that needs metamorphosis to evolve and cope with our future habitat and behaviour.

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Exploring summative peer assessment during a hybrid undergraduate supply chain course using Moodle

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The main hypothesis of this recent study was that student peer assessing could produce a fair grade in a hybrid undergraduate supply chain course. A key challenge was there were three long written assignments weighted at 90% of the course spread throughout 15 weeks (the final exam in week 16 was weighted at 10%). The secondary goal was to explore if Moodle could facilitate the online assessment of the three project management plans (PPs). A PP was approximately 25 single-spaced pages, based on a unique initiative for each of the 45 students, and it was evaluated against nine Project Management Body of Knowledge (PMBOK) standards as well as other course learning objectives. The PMBOK lectures were classroom-based, data collection was field-based for authentic experiential learning while the LMS was essential for material sharing and assignment management. Interrater reliability, correlation and pair-wise t-test estimates supported the hypotheses. Peer assessments were found to be reliable between students and consistent with the professor's evaluations. Moodle's workshop module was effective but there were two minor shortcomings: (1) reliabilities must be estimated manually, and (2) there was only one rudimentary algorithm in Moodle to calculate the student rater grade for peer assessment quality.

Keywords: summative peer assessment; Moodle workshop; interrater reliability agreement; student peer grading; undergraduate supply chain project management hybrid course.

Introduction

This study contributes to ASCILITE's Electric Dreams community of practice by reviewing the past literature and reporting a successful endeavor which applied summative student peer assessments using Moodle as the Learning Management System (LMS) for a bybrid-mode course (with combinations of classroom, field and online student learning). The findings from this study will inform and motivate future research.

The underlying motive for this study was sadly not merely towards better teaching and learning but rather to improve the efficiency of current practices out of necessity because of increased workload. Faculty must find ways to leverage technology in pedagogy, for continuous improvement and out of necessity due to teaching larger classes. Public university budgets shrank while student enrollment increased in USA as more adults sought degrees to retool or to increase employment competitiveness (United Union Professionals, 2013). Business school faculty are under pressure from disciplinary accreditation entities to increase scholarly research publications and to provide summative assessments which show students are learning (Association to Advance Collegiate Schools of Business, 2013; Accreditation Council for Business Schools and Programs, 2013).

The macro level problem was that many universities in USA had expanded prior to the economic recession by opening additional campuses yet now they found themselves with more students and less budget. In fact, one of the cost-cutting measures taken by the collective group of State University of New York institutions (SUNY) during 2010 was to replace the expensive Blackboard and Angel LMS commercial products with open source

Moodle (developed in Australia). Moodle is free, in terms of purchase price, but it requires expertise from faculty to properly leverage it for pedagogy. Moodle also requires considerable support from the technology staff to implement and manage it. Collectively, SUNY institutions have approximately 468,000 students and over 3 million alumni. Thus, Moodle best practices developed at SUNY are likely to be worth sharing with the global educational community.

The micro level dilemma was that many SUNY institutions needed effective ways to teach large face-to-face courses across different campuses. In the case study, the professor needed to teach the same multi-section face-to-face course at two physical campuses, with a four-hour return drive between them through the Adirondack Mountains in New York State during winter. Many universities around the world face comparable challenges delivering effective education programs to their clients across geographic distances, so those practitioners may be interested in the outcomes of this study.

The course content was predominately qualitative in nature, which required students to produce essays and give periodic presentations of their progress. One of the learning objectives required students to conduct peer assessments, which therefore had to be structured in a way so that fair grades could be given. Students were evaluated on their ability to fairly assess peers (10% of course points), and in turn, students were assessed by their peers (yet the professor was responsible for ultimately evaluating every student outcome).

Peer assessment is an effective pedagogy technique (Falchikov & Goldfinch, 2000; Green & Johnson, 2010; Russell & Airasian, 2012; Speyer, Pilz, Van Der Kruis & Brunings, 2011). Many researchers have published studies demonstrating that peer assessing is helpful to the learning process (Bayat & Naicker, 2012; DiVall et al., 2012; Dollisso & Koundinya, 2011; Finn & Garner, 2011; Gielen, Dochy & Onghena, 2011; Gielen, Dochy, Onghena, Struyven & Smeets, 2011; Heyman & Sailors, 2011; KoÃ, 2011; Kritikos, Woulfe, Sukkar & Saini, 2011; Li, 2011; Li & Lei-na, 2012; Li, Liu & Zhou, 2012; Lu & Law, 2012; Lu & Zhang, 2012; Nicholson, 2011; Nulty, 2011; Shih, 2011; Thomas, Martin & Pleasants, 2011; Wu, Davison & Sheehan, 2012; Wu, Hou & Hwang, 2012; Zhang & Blakey, 2012; Zhi-Feng, Liu & Lee, 2013).

When Falchikov and Goldfinch (2000*,* p. 314) examined 48 studies they found the "mean correlation over all studies was 0.69, indicating evidence of agreement between peer and teacher marks on average." This indicated that a large portion of these were valid based on the benchmark of 0.70 for reliability (Hair, Black, Babin, Anderson & Tatham, 2006; McCabe, 2007).

There have been various standalone software (e.g., iPeer; WebPA; SPARK) or subsystems (e.g., PeerMark within TurnItIn) for implementing peer assessments. In this study the goal was to utilize Moodle if possible since it was the sanctioned LMS. Moodle has a workshop module specifically developed for facilitating student peer assessments. However, there was no information in the literature as evidence of its effectiveness or about how to configure Moodle for student peer assessments in a face-to-face university business course. More so, there were no guidelines for measuring the consistency of peer assessments. Furthermore, a pilot study by the author using Moodle workshop had revealed that the peer assessment algorithm was not totally reliable, and several experienced Moodle programmers have documented these minor problems (Mudrak, 2011b).

One mandate of this study was to structure pedagogy to include Moodle (technology) to facilitate peer assessment and fair grading of student assignments. Another objective was to statistically measure the interrater reliability of the student peer assessments compared with the professor. An additional goal was to statistically estimate the reliability of using a Moodle workshop for peer assessment. Inductively, recommendations were needed for applying Moodle workshop LMS in higher education practice and for conducting further research.

Literature review

First peer assessment theory in higher education was reviewed, followed by relevant empirical studies. Then the application of peer assessment using LMS technology, specifically Moodle, was researched.

Peer assessment theory

Good quality higher education programs should encourage interaction and use peer assessments in the pedagogy (Johnson & Aragon, 2003). Peer assessments should be used in addition to faculty-generated and self-regulated feedback because students learn best from multiple sources (Strang, 2010b), and through a variety of learning style matches with their professors or tutors (Strang, 2008, 2010a).

Measurement of performance against objective criteria is the fundamental task in a peer assessment, which needs to be clearly structured and simple, in order to be effective for students to administer (Falchikov & Goldfinch, 2000). The words 'assessment' and 'evaluation' are frequently used interchangeably, but they differ in significant ways. Assessments are written, oral, observational, and/or quantitative performance marks (e.g., test scores) that provide information to determine how well a student has progressed toward the intended objectives (Green & Johnson, 2010). Evaluations use the assessments to make judgments about a student's ability and to inform decisions about continued pedagogy (Green & Johnson, 2010). Therefore, peer assessment is concerned with the student grading assignments based on predefined criteria, while faculty will generally evaluate assessment scores to inform ongoing pedagogy.

The words 'formative' and 'summative' are also often mentioned in peer assessments. Formative refers to a pedagogical process done by the professor or students during the course to measure student understanding of the material, as well as to monitor and guide future pedagogy (Russell & Airasian, 2012). Summative is the evaluation done at the end of the teaching process for a group of concepts, albeit not necessarily at the end of the course (Russell & Airasian, 2012). Usually formative assessments are given by the professor as questions posed during the class (or online in a forum) while summative evaluations are done at the end of a learning unit through tests or assignments with predetermined rubrics for grading. Peer student assessments are usually summative in nature (Green & Johnson, 2010) but they could be formative or both depending on the application. "By definition, all student works that contribute to course grades are summative. […] Grades may be pressed into doing double duty: formative and summative" (Sadler, 2009, p. 808). As Sandler implied, formative and summative peer assessments are useful in as far as they provide extrinsic motivation and intrinsic self-efficacy.

The key theoretical problems with peer assessments, including faculty-provided assessments, are reliability, validity, bias and automation with technology. Peer assessment reliability refers to the degree that scores on the assessment are consistent and stable across multiple raters: students, faculty or combinations of both (Green & Johnson, 2010). The three common sources of error in peer assessments which decrease reliability are: occasion (differences in time and context), items (some raters may not fully understand all criteria or perceive them differently), and scoring issues associated with bias between students and their raters (Green & Johnson, 2010).

A clear design using an objective rubric can reduce bias and improve validity while statistical estimates such as interrater agreement can be generated to measure reliability (Hair, Black, Babin, Anderson & Tatham, 2006; McCabe, 2007; Strang, 2009). A LMS can be used for peer assessments to streamline peer assessment implementation and to improve the effectiveness of the process as well as student learning (Bitter & Legacy, 2008).

Peer assessment validity is the extent to which the instrument provides an accurate, representative, and relevant measure of student performance for its intended purpose (Green & Johnson, 2010). Construct-related rigor is obtained by ensuring the rubric is clear. Content-related validity refers to refers measuring the correct objectives. Criterion-related validity refers to using relevant and easy to understand scoring scales, which the raters will use such as nominal, good versus bad wording, or ordinal, e.g., Likert 1 to 10 ratings (Strang, 2009).

Differences between the socio-cultural factors of the rater versus rubric creator versus student often impact the validity and reliability of peer assessments (Li, 2011; Mok, 2011; Shih, 2011). Researchers have argued there will be disagreement between raters regardless of whether they are students or faculty (Falchikov & Goldfinch, 2000). However, the concept behind randomized allocation or peer assessors is derived from the normal distribution in that with enough raters, individual differences should average out (Russell & Airasian, 2012). Evaluator differences also reflect the real world workplace so this is another argument supporting peer assessments.

Falchikov and Goldfinch (2000) acknowledged that faculty may not use peer assessments because they are afraid students will not be able to evaluate assignments reliably or that student marks will not be consistent with what faculty would do. Other researchers concurred with this (Bedore & O'Sullivan, 2011). Nonetheless, this is an effective learning strategy and pedagogy, in that students learn to improve during the course from the feedback on a formative basis, and faculty may use the assessment scores as part of the grading towards the course learning objectives in a summative manner. Additionally, on the assumption that the student assessing is done fairly, this off loads a large part of the evaluation work from busy faculty when enrollment is large and when the types of assignments are qualitative in nature with long written reports.

Peer assessment studies

Speyer, Pilz, Van Der Kruis and Brunings (2011) searched 2899 studies in the educational psychology literature for the period ending May 2010 to report the use of peer assessment as a pedagogy. They concluded that peer assessment was widely used and it was an effective educational intervention, which improved learning. Their advice for making peer assessment effective was to use an instrument linked to the learning objectives which has high reliability and validity. In effect what they were recommending from empirical experience was to use a rubric to improve objectivity within raters and to increase consistency between raters. They found most peer assessment rubrics did not provide sufficient psychometric measures to ensure students were receiving a fair result. An important assertion they mentioned was “an instrument for educational purposes can only be justified by its sufficient reliability and validity as well as the discriminative and evaluative purposes of the assessment” (Speyer et al., 2011, p. 583). A key limitation of their research was that they reviewed only 1% (28) of those studies in detail which did not appear to conform to the systematic sampling methodology they planned. Unfortunately no guidelines were given for benchmarks (e.g., mean acceptable consistency) or by way of methods and formulas to implement peer assessments. Furthermore they did not differentiate between formative versus summative assessment yet according to their discussion the latter was assumed.

Falchikov and Goldfinch (2000) performed a landmark meta-analysis of 48 empirical student peer assessment studies, finding that student evaluations of their peers were effective, with Pearson Product Moment Correlation r ranging from 0.14 to 0.99 (mean r was 0.69). They weighted the r calculation by sample size and number of comparisons made, thus larger cohorts would have a greater influence on their result. The nature of the subject matter in these studies were generally qualitative assignments which they described as "academic product and process" (Falchikov & Goldfinch, 2000, p. 310), such as reports and presentations.

In their meta-analysis Falchikov and Goldfinch (2000) calculated the correlation R of academic product and process assessments as (0.75 (combined N=39 studies). The cause-effect coefficient of determination r for the peer assessments in the business discipline was 0.71 (N=11). They calculated an overall weighted effect size (from 24 experimental studies) to be 24% which is a large effect (Cohen, 1992). This indicates that empirical studies have shown student assessments of their peers to be effective in terms of consistency with faculty evaluations of the same assignment.

Surprisingly, they also found that correlations between student and faculty peer assessment of assignments did not increase as the number of students increased. The optimal number of raters for peer assessment based on meta-analysis research was 3-5; with more raters, consistency drops (Falchikov & Goldfinch, 2000). Interestingly, they found that the quality of student peer assessment did not significantly differ across disciplines or based on tenure of the student (time in the program, such as year 1 versus year 4).

Li (2011) evaluated peer assessment in a project management course (similar to this study) at a university in Georgia (USA). She analyzed the student perceptions and outcomes of peer assessment effectiveness as pedagogy. She found that students in early learning development stages showed more learning gains than high achieving students. However, all students held positive attitudes towards their peer assessment experience. This indicates the peer evaluation process was effective as a formative assessment. Li, Xiongyi and Yuchun (2012) conducted a follow up study on this data which confirmed the importance of peer feedback. Their approach was to use assessments during the course to help students self-regulate their learning and also as a mechanism for grading. Nulty (2011) published a study whereby he recommended using peer assessment early in the students learning cycle. Additionally he cautioned against the disadvantages of using self-assessments due to bias.

Liu and Lee (2013) investigated peer observation and feedback on student learning during a psychology course in Taiwan. They determined that peer assessment was helpful to students, but more so later on in the course. An important finding from their work was that students got better at peer assessment with practice. Therefore, an important implication would be requiring students to first complete a practice peer assessment.

Some faculty use peer assessment informally rather than as a grading mechanism. Heyman and Sailors (2011) found that traditional peer assessments helped students learn the material better. They also proposed an interesting approach to better the perceptions and learning styles between raters and peers by having students nominate their raters. However, this would be time consuming for large classes involving multiple assessments. An important concept arising from their study was to reinforce the idea of students practicing peer assessments. The findings from these studies suggest peer assessments are valuable to use on a formative and summative basis.

Peer assessment using technology

One of the well-known scholarly advocates of using technology in education (including peer assessments) was Laurillard (2007). She surveyed 19 higher-education institutions from 13 countries in Asia-Pacific region (Eurpore, Latin America, and North America) to determine the effectiveness of using technology for pedagogy. Her recommendation was to leverage LMS technology to better manage large cohorts.

Bitter and Legacy (2008) emphasized that technology should be subservient to learning objectives when conducting peer assessments through technology. They argued peer assessments are more effective for evaluating (and for student learning) with qualitative assignments, such as team projects and presentations, since there is so much to review, more raters are better able to observe different perspectives to enhance the constructive feedback. Rubrics linked to course learning objective should be designed for objectivity, which refer to competencies, abilities, and attitudes. They offered tips for using peer assessment rubrics in a LMS:

- Avoid highly detailed criteria that become more of a checklist than a rubric;
- Use a limited number of dimensions (aspects, categories);
- Focus on learning priorities of the project;
- Use measurable criteria that can be counted or ranked (such as ordinals, Likert 1-5 or 1-10 scales);
- Use four performance levels that make fine enough discrimination, yet are not too divisive (see below);
- Maintain an equal interval distance between levels so that the highest and next highest are an equal distance to the lowest and next lowest;
- Involve students in creating rubrics so they will clearly understand what the expectations are and this will encourage student support of the process; (adapted from: Bayat & Naicker, 2012; Bitter & Legacy, 2008).

Willey and Gardner (2010) developed a peer assessment model along with a software product called SPARKplus to automate the process. The software could be easily integrated into a LMS. Their model was based on two simple formulas. The first formula 'SPA' was calculated as the square root of total ratings for an individual assessment divided by average of total ratings for al l team members. The limitation for this rating is that it may provide a coefficient larger than 1.0 so a nonlinear correction procedure (manual or programmed) would be needed to implement this for grading purposes. The grade is then calculated by multiplying the SPA by the team score. This cannot be implemented for individual projects as was the case in this study (unless only the SPA coefficient were used with a nonlinear correction algorithm). There were no team projects here only individual projects which were double blind assessed by five other peers. Also their model did not report reliabilities to ensure the peer assessments were consistent, which was essentially the goal of this study.

Thomas, Martin and Pleasants (2011) found the type of technology used for peer assessment did not matter as long as learning objectives were clear. They used wikis for peer assessment at the University of Wollongong. A useful contribution was their recognition that the 'learning value' of peer assessments must be explained to students rather than merely forcing students to use them.

One of the more novel approaches was by Wu, Hou and Hwang (2012) since they used online text messaging as a peer assessment methodology for 38 students. More importantly, they reminded us about the importance of content validity and criterion reliability for peer assessment rubrics. They recommended faculty use Blooms cognitive domain when designing the peer assessment rubric. Interestingly, Lu and Law (2012) published a similar study, echoing the advice to use Blooms Taxonomy to inform the design of the rubric.

Neus (2011) pointed out that raters need to be graded to so as to provide accountability for their peer assessment. However, the biggest issue concerning using peer assessments seems to be how to mathematically calculate grades for the rater (assuming the average of peer ratings would form the score of the rated student). He demonstrated a technique for calculating a correlation coefficient for grading the rater using SAS. The problem with correlation is that since it is a bivariate measure, it works with only two variables, which would mean only up to two raters could be assessed to calculate a 'rater effectiveness' coefficient. In addition, Pearson Product Moment correlation can only be applied to ratio level data not ordinals or intervals such as Likert scales.

Zhang and Blakey (2012) used factor analysis to assign grades to raters for their peer assessments. They were able to validate their rubric assessment scale with Cronbach's reliability values greater than 0.70 and the instrument was able to capture 67% of the variance between rater scores on each assignment. However, factor analysis is a complicated process and it seemed difficult to associate to the rubric.

Dollisso and Koundinya (2011) used paired t-tests to grade raters based on their peer assessments resulting in an effect size of 0.06. The rating scales were 10-point Likert type so these could be considered ordinal data type. Pair wise t-tests would be a labor-intensive technique to assess more than one rater. Nonetheless their concept has merit since ANOVA is designed to compare the variance of ratings when using ration data while the Kruskall-Wallace test can be used as the nonparametric equivalent of ANOVA when the ratings are in ordinal scales such as the traditional letter grades A-F (Strang, 2009).

Peer assessment in Moodle

The workshop module in Moodle is designed to automate peer assessments. A grade is given for the assessment (from peers) and a separate grade is given to each rater. The grade for the assessment is simple - it is the average from all raters (with optional weighting if the instructor wishes to contribute a peer assessment). Self-assessments are also possible but this was not used in this study due to self-prophecy bias: Students will tend to overrate their own performance. Currently only positive integers (as Likert scales) are available in Moodle workshop for ratings. This limits the applicable statistical techniques. There are two assessment formats: accumulative or rubric, which function similarly (the latter is more structured).

There is only one method implemented in Moodle workshop version 2.0 for rater grading which is called 'best assessment'. The underlying methodology is not well explained and a pilot study returned inconsistent results where two identical raters (having the same peer assessment scenarios) were given different scores. The basic idea is that a best assessment is identified and the rater is given a 'coefficient' based on the differences in their scores from the best one for each rubric aspect: $((\text{best score - peer score}) * \text{weighting / max possible score}))^2$.

The Moodle 2.4 workshop module version 2.0 documentation states:

> Grade for assessment tries to estimate the quality of assessments that the participant gave to the peers. This grade (also known as grading grade) is calculated by the artificial intelligence hidden within the Workshop module as it tries to do typical teacher's job. There is not a single formula to describe the calculation. However, the process is deterministic. Workshop picks one of the assessments as the best one - that is closest to the mean of all assessments - and gives it 100% grade. Then it measures a 'distance' of all other assessments from this best one and gives them the lower grade, the more different they are from the best (given that the best one represents a consensus of the majority of assessors). The parameter of the calculation is how strict we should be, that is how quickly the grades fall down if they differ from the best one (Mudrak, 2011a).

The 'best assessment' is determined for each rubric aspect based on finding a peer assessment grade from all raters that has a standard deviation very close to zero. "In some situations there might be two assessments with the same variance (distance from the mean) but the different grade. In this situation, the module has to warn the teacher and ask her to assess the submission (so her assessment hopefully helps to decide) or give grades for assessment manually - there is a bug in the current version linked with this situation" (Mudrak, 2011b).

The grade for assessment (given to a student for assessing peers) is calculated using the 'comparison of assessments' setting in workshop which is then multiplied by the 'best assessment difference' coefficient. The "comparison of assessments" values are: 5.00 = very strict, 3.00 = strict, 2.50 = fair, 1.67 = lax, 1.00 = very lax (Mudrak, 2011b). For a simplistic example, if the 'best assessment difference coefficient' were 10%, and if the fair setting were used for 'comparison of assessments', then the 'grade for assessment' = 1-(10%*2.5) = 75%.

Synthesis and research questions

Based on the literature review, peer assessment (automated by a LMS) is a useful to facilitate pedagogy. Peer assessments require a clear rubric without too many criteria items (Bayat & Naicker, 2012; Bitter & Legacy, 2008). In the Moodle workshop module these are called aspects. Likert rating scales from 1 to 10 were recommended (Dollisso & Koundinya, 2011).

The following research questions arose based on the literature review and from the problems noted earlier:
1. Would students rate their peers reliably?
2. Would the student peer ratings be consistent with faculty assessments of the same student assignments?
3. Is the Moodle workshop module effective as a LMS to facilitate student peer assessing?

Methods, procedures and materials

The researcher employed a theory-dependent positivist philosophy consisting of a deductive literature review (above) to inform the research questions, instrument design, and methods (Gill, Johnson & Clark, 2010; Strang, 2013). Since this study was designed to collect performance data, quantitative techniques were selected to answer the research questions concerning student peer assessment validity and reliability (Creswell, 2009).

Descriptive statistics, correlation, interrater reliability and validity tests were applied at the 95% confidence level. SPSS version 14.1 was used for the statistical tests, while Moodle version 2.4 and workshop version 2.0 were installed at SUNY for this quasi-experiment.

Case study participants

In terms of sampling method, natural intact convenience groups (existing classes) were used at the SUNY Plattsburgh and Queensbury campuses, a public comprehensive university located north of the state capital Albany NY (USA). The enrollment at this university was 6350 matriculated students, with 1050 of those in the School of Business and Economics, of which approximately 350 were in the undergraduate Bachelor of Science in Business Administration (BSBA) program at the time of writing.

At the university level, the average class size was 22, the student-faculty ratio was 17:1, and 97% of tenure-track faculty held the highest degree (e.g., PhD or doctorate) in their discipline. The gender balance was 45.1% male, 54.9% female. International enrollment from 63 countries represented 5.4% of the population.

In the business school 65% of faculty held a relevant doctorate or at least a PhD. The size of this class was 45 due to its demand at both campuses, thus making the ratio 45:1. The researcher had taught large classes of over 600 students so he was familiar with using technology out of necessity to facilitate applying pedagogy in large cohorts. The mean age of the sample was 23 (SD=2.1), while females represented 59% of the class. There were three international students in the sample from different countries (3/45 = 6.7%). The demographic factor and GPA estimates of the sample were similar to the university's business school population (based on z-score tests).

Instrumentation

All 45 participants were undergraduate students in the upper division Project Management (PM) course taught by the researcher. There was one teaching assistant. This course had been taught by the researcher for two years in this context using Moodle, and before that this professor had taught a similar version of this course at other universities using Blackboard, Angel, Moodle and a proprietary LMS. A pilot had been successfully completed in a previous term using an identical course syllabus and with the same configuration in Moodle.

There were four summative assessments, as enumerated below (with course weighting in parenthesis):

- Project management plan 1 (PP1) - knowledge competency or career advancement (20 points);
- Project management plan 2 (PP2) - natural or man-made disaster preparation or mitigation (30 points);
- Project management plan 3 (PP3) - real estate capital investment development (40 points);
- Project management knowledge test - comprehensive and cumulative exam (10 points).

Moodle workshop was utilized for all three PPs. Each PP was around 25 pages. The course weighting for each PP was progressively higher because students were expected to improve their competencies and each PP assignment was more difficult. The format of the PPs were that a multi-page project mandate was presented by the professor then industry subject matter experts were brought in for the students to interview. The grade for each PP was broken into two components: 90% for the charter presentation and plan submission, plus 10% for the quality of the peer assessments performed on other students. The grade for the first component was calculated in Moodle workshop as the un-weighted average of all peer generated scores. The grade for the second component was calculated by Moodle workshop using the 'best assessment' algorithm which was explained earlier.

Students were randomly allocated 5 peer reviewers in Moodle workshop. All peer reviews were based on a rubric (listed in Appendix 1) and each reviewer marks was weighted at 1. The 'comparison of assessments' of fair (2.5) was specified for all PPs. The professor did not complete a review in workshop but instead he manually assessed each PP using the rubric (for experimental control). The ratings were informed by the revised *Taxonomy for Education* (Anderson & Krathwohl, 2001), which range from lowest to highest levels of learning as: remembering, understanding, applying, analyzing, evaluating, and applying (Strang, 2011).

First a mandatory practice PP0 was setup (using a simple class exercise for a General Electric/National Grid project plan) to allow students to become familiar with peer assessing and Moodle workshop. Each PP required students to demonstrate competency in all nine project management knowledge areas. Competencies included using PM software, developing Gantt schedules, applying risk quantification using Program Evaluation and

Review Technique (Strang & Symonds, 2012), and orally presenting the executive summary charter in class through the video conferencing system since two physical campus locations were synchronously linked together for this course. The PM software was OpenProject a free product available from the open software foundation which was similar to Microsoft Project commercial software.

Results, discussion and conclusions

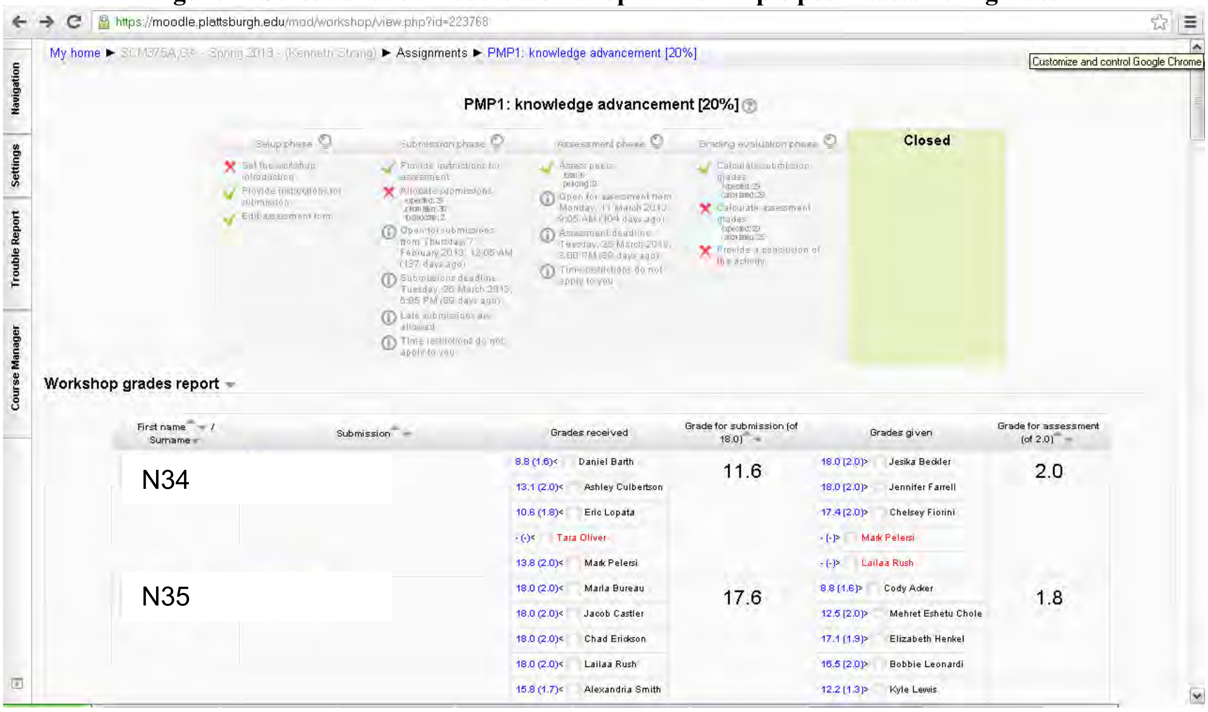
Moodle workshop module implementation

Figure 1 illustrates the first few results for PP1 from the Moodle workshop. The proportion for the submission was set at 18/20 leaving 2/20 for the peer assessment grade. In figure 1, student N34 was given a score of 11.6/20 which Moodle calculated as the mean of peer assessments (multiplied by weights, which were set at 1): (8.8 + 13.1 + 10.6 + 13.8) / 4 = 11.6 (rounded). The score of 2.0 for the peer assessment was calculated based on there being no significant difference between his peer assessment score and the scores from other peers on the same PPs.

N35, the second student in figure 1, received a submission score calculated as the average of: 18 + 18 + 18 + 18 + 15.8 = 17.6 (rounded). His peer grading mark was 1.8/2 (90%) based on the two calculations: difference coefficients = 0.01 + 0.001 + 0.008 + 0.001 + 0.02 = 0.04; peer grading mark = (1 - 2.5 * 0.04/1) = 0.9 * 2 = 1.8.

Based on these results, it appeared that the first research question was supported in that raters were scored reliably using the Moodle workshop 'best assessment' technique. However, additional testing was needed to confirm support for this and to answer the second research question of would the peer ratings be consistent with faculty assessments of the same student assignments.

Figure 1: Screen shot of Moodle workshop with example peer assessment grades



Interrater reliability and comparative reliability tests

In order to answer these questions, interrater reliability was calculated for each PP based on the 5 student raters (or less in a few situations with missing submissions). This can be achieved using a variation of Kappa's interrater reliability (Cohen, 1968) based on the work of Fleiss, Nee and Landis (1979); according to the formula in equation 1.

In equation 1, f is the Fleiss-Kappa interrater coefficient (higher values mean more consistency), where k = number of Likert scale levels, n = number of rubric aspect categories receiving a k rating, r = number of raters, x^2 = chi square of

$$f = 1 - \frac{nr^2 - \sum_{i=1}^{n} \sum_{j=1}^{k} x_{ij}^2}{nr(r-1)\sum_{j=1}^{k} p_j q_j} \quad (1)$$

difference between expected and observed ratings for each *k* rating by each *r* rater, p_j = mean proportion for *k* rating *j*, and q_j = compliment of p_j (1 – mean proportion for mean proportion for each *k* rating *j*). Subscripts *i* and *j* are matrix indexes, which point to individual Likert ratings by each rater (*r*) for each rubric aspect (*n*).

The ***f*** was calculated for each student across all 3 PP assignments, whereby all coefficients were above 0.60 and most were close to 0.80. A benchmark for good interrater agreement is generally 0.80 (Cohen, Cohen, West & Aiken, 2003) but some researchers have accepted 0.70 (Hair, Black, Babin, Anderson & Tatham, 2006; McCabe, 2007) which is the benchmark applied in this study.

For example, an ***f*** coefficient was calculated using the data for student N35 as shown in table 1 (scores were scaled to 18 for the PP2 assignment and rounded). PP2 was weighted at 20 points (out of 100 for the course), and the submission plus presentation component was weighted at 90%. Therefore, 90% * 20 = 18 points, leaving 10% * 20 = 2 points for the quality of peer assessment grade. Note that the k value was 5 because the rating scale was zero to 4. The ***f*** kappa (r=5, n=9, k=5) = 0.79, s^2= 0.0075, z =9.138, p=0.000, N=35 (DF=31), with control intervals for the ***f*** (0.62, 0.96). This 79% coefficient was a statistically significant result with acceptable interrater agreement based on research practices (Hair, Black, Babin, Anderson & Tatham, 2006) - however this was illustrated for the peer assessments on only a single student PP. The kappa's were manually calculated for all assessments with a mean of 0.80 interval (0.62, 0.96). Thus there was preliminary support of the first research question that students gave their peers a fair grade.

Table 1: Peer assessment grades for student N35 (M=17.6; 5 raters, 9 aspects, 5 scale levels)

Rubric criterion (aspect)	Marla	Jacob	Chad	Lailaa	Alex
Integration management	4	4	4	4	4
Scope management	4	4	4	4	4
Time management	4	4	4	4	4
Cost management	4	4	4	4	4
Risk management	4	4	4	4	4
Human resource management	4	4	4	4	4
Quality management	4	4	4	4	4
Communications management	4	4	4	4	2
Procurement management	4	4	4	4	2
Score (scaled to 18 total)	18	18	18	18	16

Then to answer the second research question, the average peer-generated score for each PP was compared with the professors' score, which was estimated statistically by applying a paired t-test. A two-tailed test was selected because the goal was to test the inequality of the Moodle workshop grade (average of peer ratings) as compared to the grade given by the professor. The results of the paired t-test supported the research question, D (134) = 0.31, p=0.76 (two-tailed). In this case, it was desirable to see no significant difference between scores.

The nonparametric Spearman correlation was very high between each students ***f*** and the peer assessment grade given in Moodle (score out of 2): Rho r = 0.92, p=0.000 (two sided), n=45 students, N=135 assignments. Spearman correlation is more conservative than Pearson Product Moment and the former does not assume a normal distribution underlies the evaluation results (furthermore we cannot expect students to grade on the curve or that there ought to be 68% of the mean ratings with one SD of the mean for a peer assessment). Therefore, the third research question was accepted in that Moodle was useful in managing the peer assessing process and the algorithm calculated a fair peer grade to each student which was similar to the kappa (92% correlation). This was proven by comparing the workshop peer grade score for all 135 assignments to the ***f*** interrater agreement.

Limitations and recommendations

A key limitation in this research, which affects any generalizations, was the small sample size of 45 students. Additional the context of SUNY may not be similar to other universities. For example the international composition of this SUNY institution was 5.4% (from 63 countries) and there were three international students in the sample (3/45 = 6.7%). Furthermore, this quasi-experiment was applied on business school undergraduate students. Fourthly, the professor's pedagogical approaches may differ substantially from others.

Notwithstanding the above, there was strong evidence to support both research propositions that Moodle workshop can be effectively used for peer assessments. There were no instances of students receiving an incorrect peer grade and the high correlation of 92% between peer grades and Fleiss-Kappa interrater reliability for each assignment indicated a high level of consistency. However, this study should be replicated with larger samples, across other disciplines, at different institutions, in different socio-cultures, and in online modality.

The researcher did not locate any other LMS, which provided a peer assessment module as Moodle did. This is also an area of recommended future research - to provide peer assessment modules for the other LMS products.

Implications and future research

Moodle workshop was effective. There was statistical support in that there was no significant difference between the professor grading versus the student peer assessments on all 3 assignments (N=45 students).

One suggestion for future research would be for the Moodle developers to implement a Kappa statistical score into workshop, which could provide another peer grading alternative. Furthermore, it would provide faculty with statistical estimates of how well the students were performing regarding their peer assessments. From that, professors could adjust the student grades and provide constructive feedback to students about their peer assessing skills, substantiated with scientific evidence (rather than observations of the work done).

Students can learn from the peer assessment process, not only about how to assess, but they may also see alternative approaches for applying the theories taught in the course. Peer assessments were formative as well as summative in nature since they were distributed throughout the course schedule and the scores contributed towards the final grades. Students appreciated the peer assessment pedagogy based on the fact that several made reflective comments in the course opinion survey. Students were very satisfied with this course, which had an overall mean rating of 4.7 out of 5 for the instructional items on the survey (SD=0.6, N=37 respondents).

In closing, the researcher noted the most significant benefit from this study was confirming the reliable application of the technology-enabled Moodle workshop for peer assessments. Although the professor still assessed every student assignment in this course (N=135), if the Kappa interrater reliability statistic had been available, he could have just randomly sampled a few, thus saving a tremendous amount of time. This methodology would be extremely valuable for large cohorts in qualitative subject oriented courses where there are numerous items to assess.

For example, the researcher took on average 20 minutes to assess each project plan in this course. There were 3 * 45 = 135 project plans (excepting that one student did not submit a PP1 due to illness). Therefore, assuming other professors would take similar time to assess such assignments in other courses, a total of 270 minutes would be needed for this activity. If the professor instead merely sampled 10% of the assignments, based upon the potential availability of a built-in Kappa interrater reliability statistic (or having access to SPSS to calculate this), and further assuming the students were capable of assessing peer assignments (as was this cohort), the professor would save 270 * 90% = 243 minutes or about 4 hours every course. If this savings were extrapolated across the entire school of business at this university for a year, it was estimated that the time equivalent to another faculty position would be saved. Imagine the potential benefits if this concept of technology-facilitated student peer assessing were applied at all business schools and in other disciplines? This might be an effective pedagogy if a reliability coefficient was calculated and reported in the LMS Moodle workshop module.

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Appendix 1: Peer assessment rubric applied in Moodle workshop

Aspect (category)	Criteria	Rating (0-4)
Integration management	a. first page has project correct title, PM name, date, course number; b. project is unique (and approved online in PMIS); c. version log is present and realistically completed (version 1 or similar); d. table of contents if accurate and well formatted; e. charter mentions key items from scope such as key deliverable and reason for project, overall cost and time, PM; f. all other eight sections are present; g. APA references at end for citations to sources; h. spelling, grammar, and professional business writing and speaking evident at all times; i. uploaded in PDF format with OpenProj or Planner Gantt file attached.	
Scope management	a. indicated exact nature of project; b. some background (with a citation to literature or news article); c. start and complete date (or duration); d. at least one key deliverable (relates to reason for doing project); e. at least one assumption; f. at least one constraint; g. spelling, grammar, and professional business writing and speaking evident at all times.	
Time management	a. includes Gantt with tasks shown; b. at least 3 resources (PM + 2); c. sequence and links can be seen; d. indentation used with WBS numbers; e. at least one milestone visible; f. formatted clearly and professionally with no duplication from risk or other sections; g. spelling, grammar, and professional business writing and speaking evident at all times (including timely delivery of charter briefing presentation).	
Cost management	a. includes external and internal unit costs summarized by category; b. at least 2 levels of detail (categories); c. overall total; d. earned value formula shown; e. earned value calculation correct; f. SPI and CPI shown as percentages; g. implications on budget discussed; h. no duplication from procurement or other sections; i. spelling, grammar, and professional business writing and speaking.	
Human resource management	a. at least 3 resource roles explained; b. costs shown (including PM); c. listed in table format (resource allocation matrix); d. unit costs given; e. same resources as shown on Gantt chart; g. material resources shown; f. person resources used; g. spelling, grammar, and professional business writing and speaking.	
Risk management	Internal risks: a. method for estimating internal risks listed; b. table included (well formatted, labeled, referenced in text), shows risky tasks, and overall critical path method risk (standard deviation); c. shows probability project will finish 10% earlier than expected duration.; External risks: d. method for estimating external risks listed; e. identification (2-3 likely risks listed applicable if the project were underway); f. sources for risks noted (subject expert interviews); g. spelling, grammar, professional business writing and speaking.	
Quality management	a. at least 3 key (reasonable) quality goals identified; b. key criteria in a matrix (table with heading etc), c. selection of method to measure quality explained; d. formulae or benchmarks identified; e. citations to quality guidelines; f. zero defects; h. spelling, grammar, professional business writing and speaking.	
Communication management	a. at least 3 key (reasonable) stakeholders identified; b. key deliverables in a matrix (table with heading etc), c. emails for stakeholders to notify them; d. mention use of technology or method for above; interviews); e. communication matrix complete with W5+how format; g. spelling, grammar, professional business writing and speaking during project charter briefing with other PM's.	
Procurement management	a. includes external and internal unit costs for materials summarized by category; b. at least 2 levels of detail (categories); c. overall total; d. contract types explained; e. justification for contract types given; f. implications on budget discussed; h. no duplication from cost or other sections; i. spelling, grammar, and professional business writing and speaking evident at all times.	
Ratings are scores of competency or proficiency, informed by the revised *Taxonomy for Education*, where: 0 is the lowest and 4 is the highest: 0 = not addressed, 1 = basic understanding but many requirements missing and typos, 2 = application of key requirements but typos and some items missing, 3 = sound analysis but typos or a few requirements missing; 4 strong demonstration of knowledge area with all requirements met.		

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Caring dialogue: A step toward realising the dream of online learning communities

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Online educators dream of facilitating interpersonal interactions equivalent to those in face-to-face classrooms as an important factor for promoting learning in online classes. Many current university students are comfortable with online networks as social spaces where they interact with family and friends, but they need help in making them effective as places of learning. A design research study found that the caring dimension of Lipman's (2003) community of inquiry was fundamental to supporting the critical and creative dialogues necessary for development of higher order thinking. It developed and refined an interactive website that may support online educators in realizing the dream of building relationships that more effectively support learning.

Keywords: Community of inquiry, dialogue, mindfulness, caring

Interaction and online learning

> Our digital native students may be able to use technologies, but that does not mean they can learn from them. Being able to read and write never meant you could therefore learn from books (Laurillard, 2013, p. xvii).

Moore (1989) noted that interaction in distance education courses could be with content, instructors, and peers. At that time most distance education was conducted using printed materials that facilitated interaction of learner with content. Interaction with the instructor was mostly by written correspondence or occasional teleconference. Moore commented on the coming challenge presented by enhanced opportunities for interaction among learners being presented by then emerging forms of computer-mediated communication. In subsequent writing he articulated the *theory of transactional distance* in which the distance in distance education came to be seen as being psychological rather than geographical (Moore, 1993) and argued for the potential of technologies to reduce transactional distance and thereby enhance learning.

At the time Moore was writing, the prospect of inexpensive and instantaneous communication to support distance learning through learner-instructor and learner-learner communication must have seemed like a dream. Successive generations of computer hardware and software have increased the options for online communication but there is still much to be learned about how best to select technologies and arrange activities to support learning through these systems. At each step the prospect of a 'perfect' system appears to recede into the distance like a dream or shimmering mirage.

There is an abundance of research that supports the importance of interpersonal interaction as a foundation for online learning. Weaver and Albion (2005) reported on a mixed methods study involving online students at an Australian university. They confirmed that learners' perceptions of social presence (salience of the other person in an interaction) and of consequent interpersonal relationships influenced their motivation for participation in online discussions. The social presence factors with most effect were those related to course work, with social interactions being rated as less important. That is, learners appreciated interaction that advanced their learning purposefully. A form of virtuous circle emerged in which participation encouraged participation making it easier to maintain momentum once discussions were initiated.

More recently, Zingaro and Oztok (2012) researched quantitative predictors of interaction in an asynchronous online course and reported that longer notes, those posted early in a discussion period, and those that included questions were more likely to attract replies. Once again there appears to be a focus on learning through the discussion rather than merely social interaction and a tendency for participation to be reciprocated.

York and Richardson (2012) described interaction as a “critical factor that impacts student learning and motivation to learn in online courses” (p. 83) and noted that research had demonstrated that online courses lacking “substantive and meaningful interaction” contributed to feelings of isolation, dissatisfied learners, and dropouts. They discussed various typologies of interactions, including the learner-learner, learner-instructor, and learner-content types proposed by Moore (1989) as background to a qualitative study that investigated the approaches that experienced online instructors used to influence interpersonal interaction in their online courses.

The driver for the research study reported in this paper was that, although many of today’s university students can operate comfortably within digital networks, as Laurillard says, they need help in learning how to learn in them. A theory-based digital “artefact” was developed and tested using a design research methodology. The theoretical model was based on a community of inquiry approach (Swann, 2010). This paper is focused on the caring aspect of the community of inquiry model, as this was found to be fundamental to the success of the critical and creative thinking and dialogue fostered in this approach and hence to realisation of the dream of more effective interaction for learning in online environments.

A community of inquiry

Lipman’s work with children was cited as an influence in the development of the most commonly-used community of inquiry model in online learning (Garrison, Anderson, & Archer, 1999). For Lipman it was essential that students felt able to express their ideas in a class which no doubt had its own internal network of relationships, friendship groups, in-groups, out-groups, power relationships and so on. For this reason Lipman included caring thinking, in order to develop in the children a respect for the ideas of others. These notions fit well with the central tenets of adult education articulated by Brookfield (2003) among others. Wegerif’s (2007) version of Lipman’s (2003) community of inquiry model brought its dialogic elements to the fore in ways which were directly relevant to the facilitation of inquiry online through asynchronous media. However, the findings of the first iteration of this research study illustrated the importance of exploring the nature of the shift of control over an inquiry from tutor to students, so Wegerif’s model was redrawn to encompass the two dimensions of control over the inquiry and disciplinary understandings of knowledge provided by the Sheffield IBL model (Levy, Little, McKinney, Nibbs, & Wood, 2010; Levy & Petrulis, 2012); and reflection on the findings of all three iterations, supported by the work of Davey (2006), led to the encompassing of critical and creative dialogue within community dialogue. This is shown in Figure 1 below.

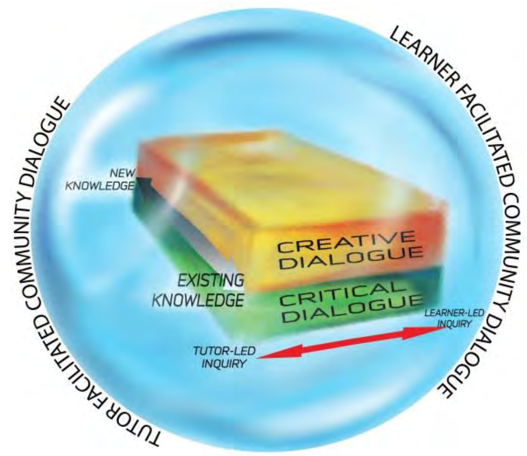

Figure 1: A model for learning through dialogic inquiry

Community dialogue

A community is generally thought of as made up of people who have something in common, and in a community of inquiry, it is the inquiry which holds it together. As applied to tertiary education, this community of inquiry might be seen as an example of a "rational community" (Biesta, 2004) in that its members are expected to engage in, or develop, the "serious speech" associated with the professions which the students hope to join. However, an online community in a formal educational setting is an artificial thing. Such a community is made up of people who have come together not necessarily voluntarily through some identified common interest, but as a result of their involvement in a course or programme. As a result, not all members have necessarily learned the language and thought processes of the dominant discourse. Those with different backgrounds may be "strangers" in the community. Strangers in this context "are those who do not fit the cognitive, moral, or aesthetic map of the world" (Bauman, 1995, p. 200 quoted in Biesta, 2004).

Such a community of inquiry must make space for the people "who have nothing in common" (Lingis, 1994) within the rational community, and this requires a different view of dialogue, a different power structure. In a rational community it is *what we say* which is important. In the adversarial world of some forms of argumentation it is *how we say it* which is important (Tannen, 1998). In Lingis's "other" community there may be no shared axioms, no shared discourse, or only a partial overlap. In a dialogic learning community it is important to build a shared language, but if the learning in this community is to be for the 21st century, the shared language must not be only that of the dominant group, since this merely perpetuates the power structures and thought patterns of the elite. Yet if there is no common language, what voice can the "insiders" use to communicate with the "outsiders"? Biesta argues that we can only truly communicate with the strangers in our rational communities by letting go of the rational discourse and using our own authentic voices. This is in addition to, rather than jettisoning, rational discourse, which has immense value for learning and for dialogue about the local, national and international issues which concern us all.

This may sound idealistic, but it is possible for a learner to be aware of and to understand the dominant discourse without necessarily subscribing to its values, as Flecha demonstrated in his literacy work with Spanish factory workers in Barcelona (Flecha, 2000).

Mindful, or caring, thinking

Understanding something well enough to be able to make a reasonable judgement about it goes beyond critical thinking. It also requires imagination about what might lie beyond what is currently known (Sprod, 2001, p. 16) and this broadening of the dialogue cannot be achieved unless the members of the community respect each other, and each other's views (Brookfield, 1986). Respect is not the same as agreement. There may be major differences in values or belief systems within a community of learners on a particular course, and acknowledging others' beliefs requires the temporary setting-aside of one's own, which may be deeply rooted. Shared understanding requires consideration of other perspectives, including those which challenge one's own and in this, relationships are more important than agreement. Discourse is caring when, "each of the participants really has in mind the other or others in their present and particular being and turns to them with the intention of establishing a living mutual relation between himself and them" (Buber, 1974, cited in Lipman, 2003, p. 91). Lipman called this caring thinking and characterised it as not only affective, empathic and appreciative but also active, normative and concerned with matters of importance (Lipman, 2003, p. 261). It seems evident that such caring contributions have potential for encouraging participation in online discussions and moving us closer to realising the dream of deeper interactions for online learning.

The "dark side" of caring

There can, however, be a mismatch between caring and friendship (Davey, 2006). Friendship may actually hinder an inquiry because friends may not like to contradict one another. In general, social relations can hinder inquiry especially when winning is seen as more important than being right. The focus of caring is on accepting of differences, rather than on seeking common interests, as in friendship (Noddings, 2003, p. 42). Friendship can also hinder inquiry when people are so close that they work together to exclude or bully others (Reed & Johnson, 1999) and this can be a particular problem online (Gaggioli, Riva, Milani, & Mazzoni, 2013). Not only does this tend to intimidate others, but it also prevents them from really joining the community, so their true values and beliefs cannot be expressed. This research study showed that the caring dimension of a community of inquiry appeared to provide an essential ecology in which the critical and creative dimensions could flourish for the development of higher order thinking.

The research study

The research study involved the development and iterative testing of an intervention, or "artefact," initially to help tertiary-level tutors to facilitate dialogue in a community of inquiry online, but ultimately to provide students with something which they could use and adapt for themselves. The artefact initially took the form of staff professional development workshops in which participating tutors could learn the community of inquiry approach by experiencing it. In later iterations, these were gradually replaced by the provision of support material in the form of "macro-scripts."

The word macro-script has been used to describe a pedagogical scenario which "structure[s] collaboration by defining a sequence of activities and assigning roles to individual learners" (Dillenbourg, Järvelä, & Fischer, 2009, p. 8). This has often been achieved through some form of computer intervention. However, Wegerif and his colleagues (2009) have interpreted the term more broadly, using well-known techniques such as de Bono's six thinking hats (1987) and SWOT analysis (Fine, 2011) as macro-scripts. In this research study the artefact eventually took the form of a website containing 20 macro-scripts, http://www.dialogicinquiry.net/dialogue/ each consisting of a set of open questions designed to stimulate and unpack some of the key features of critical, creative and caring thinking. These were derived from the literature on communities of inquiry, dialogic learning and inquiry-based learning, as well as from online help sites.

Methodology

A design research approach was taken because, as Reeves has said, it "address[es] complex problems in real contexts" (2006, p. 58) and it has an increasing number of advocates among those who wish their educational research to lead to "something [teachers] can use" (Yates, 2004, p. 162). As yet no clear definition of design research has yet emerged (Dede, 2004). Those that exist have been "a set of *process* descriptors" (Kelly, 2004, p. 118, author's italics) which provide a useful starting-point. There appears to be general agreement that a design research approach:

- **is necessarily iterative**: to provide a researcher with an awareness of the multitude of variables which may be at work in an authentic learning environment (Brown, 1992), and to allow time for critical reflection on the connection between theory and the enacted intervention and its systematic refinement in the light of its enactment.
- **is collaborative**: unlike action research, design research involves long-term collaborations among practitioners, designers and researchers which help to understand what is valuable, and why (Amiel & Reeves, 2008).
- **addresses real problems in authentic learning contexts**: showing how designs function (or fail to function) in real settings (Design-Based Research Collective, 2003). Design research usually takes place in the complex environment of a real classroom or online course which Cobb et al. call a "learning ecology" (2003).

Research Design

Each of the three iterations of the intervention focused on one of the three dimensions of the community of inquiry model, caring, critical and creative dialogue, although the analysis sought evidence of all three types of dialogue. The dialogic data was obtained from discussion forums. It may be argued that discussion forums have nowadays been superseded by more modern forms of online social interaction: Indeed, one of the reviewers of the paper quoted above referred to the analysis of discussion forums as "a hoary old chestnut." However, the technology of a discussion forum allows a dialogue to be captured and analysed with a minimum of technical and methodological difficulties. It also allowed the use of an embedded social network analysis tool. A discussion forum is designed primarily for dialogue and so was an appropriate test environment for the purposes of this research. However, no such constraints apply to the use of the artefact in the practice of learning and teaching: It could be used in any online environment, or indeed face-to-face.

The participants in this research project were graduate and post-graduate students in the fields of adult literacy, Western acupuncture and emergency management. Their ages ranged from 21 to 50, the majority being aged between 25 and 40, emerging and young adults (Tanner, Arnett, & Leis, 2009). Four academic staff members and 77 students participated in the three iterations of the research, and 439 discussion forum posts were analysed. A multi-method approach was taken in order to provide the most complete picture possible of the effectiveness (or not) of the artefact. The data analysis sought to answer two questions:

1. What are the participants saying?
2. Who are they talking to?

The first question was addressed through discourse analysis of discussion forum dialogues using coding categories derived from those used in Wegerif's ARGUNAUT project (Wegerif et al., 2009). For this iteration of the design research study the focus was on the caring dialogue component of the model.

The second was addressed using social network analysis. A browser plug-in, Social Networks Adapting Pedagogical Practice (SNAPP), was used for this because it was free and had been developed specifically for use with discussion forums in the learning management system used at the university where the research was conducted. Tutor and student questionnaires were used to check the analysis of these two sources of data.

Discourse Analysis

The discourse analysis codes used in this research study to identify caring dialogue were as follows.

Addressivity: includes use of names, type of salutation, signoff, as well as emoticons. It also included punctuation which controlled the range of possible meanings of a word or phrase which might be misunderstood, for example quotation marks.

Eliciting views: One of the goals of a community of inquiry is to explore a range of perspectives on an issue or topic, and a first step towards doing so is for participants to encourage members of the community to express theirs.

Empathy: Showing empathy provides evidence of seeing the world from another perspective.

Hedging: Hedging is an indicator of understanding that knowledge is not static and therefore there are no universal "right answers" (Vella, 2002, pp. 30–31). It also shows sensitivity to the perspectives of others through an unwillingness to cause offence by disagreeing with them, or to say something that another might disagree with in such a way that it would deter them from doing so.

Ventriloquation: When people are engaged in a true dialogue they often subconsciously pick up and use the voices of others. This could be a repetition of words or phrases used earlier by another participant in the discussion forum or it might come from a reading.

Warmth, goodwill or respect: This was an indicator of positive emotional response among participants, many of whom did not know each other before the course started and had spent little time in each others' physical presence. This category was also used to include expressions of emotional response to the course material itself.

Discourse analysis
Table 1 shows the numbers and percentages of discourse markers for caring dialogue found in the three iterations of the study.

Table 1: Numbers and percentages of discourse markers for caring dialogue

Nodes	Iteration 1		Iteration 2		Iteration 3	
	N	%	N	%	N	%
Addressivity	149	27.2	285	19.5	309	19.2
Eliciting views	3	0.5	24	1.6	29	1.8
Empathy	46	8.4	17	1.2	4	0.2
Hedging	42	7.7	220	15.1	210	13.1
Ventriloquation	14	2.6	18	1.2	14	0.9
Warmth, goodwill or respect	15	2.7	34	2.3	33	2.1

It was use of names which accounted for nearly all of the 149 items coded for addressivity in Iteration 1, which represented over 27% of all items coded in that iteration whereas in each of Iterations 2 and 3 just over 19% were coded as addressivity. In those, a large proportion of the items so coded were abbreviations or acronyms familiar to those in their fields. This is as much an indicator of intersubjective orientation as the use of names, but the nature of the relationship is more work-orientated than personal. Most of the students in Iteration 2 worked in the fields of physiotherapy or occupational therapy and those in Iteration 3 were mainly paramedics. Although the proportion of items coded as Warmth, Goodwill or Respect was about the same in each iteration, it was much more distant in the latter two groups as shown by the fewer items coded for empathy and ventriloquation. In general these indicated that dialogic enquiry could be successful among students who did not know, or get to know, each other well but who had similar professional or work backgrounds.

Eliciting views, though low in incidence, tended to be done more by the tutor in Iteration 1, where the course was fairly traditional in instructional design and facilitation. The course design in Iteration 2 deliberately put the students in control of their own learning and so most of the elicitation was done by students. The design of the discussion activity in Iteration 3 was looser and the tutor less visible during the period because she was involved in the recovery effort of the first earthquake in Christchurch. In this case some of the students simply took over her role and facilitated the dialogue themselves. They did this in different ways and with varying degrees of success, as shown by the social network analysis reported below.

The students in Iteration 2 engaged in a great deal more logical reasoning than those in Iteration 1 and those in Iteration 3 showed more dialogic reasoning. Both used more hedging language, especially where they were challenging an argument or where they were introducing a new idea or perspective. This included use of words like "possibly," "can," "could," "may," "might," as well as self-effacement like "I don't want to sound like a hippy but ...."

Social Network analysis (SNA)

A social network can be visualised through a sociogram or map which shows the connections between the participants. Of two main schools of network analysis theory, formalist and structuralist, the latter was more appropriate to this research study, as it could be used to show how relationship patterns could help us to understand a specific aspect of our own discipline (Scott & Carrington, 2011).

SNA can show who is participating, who is not, who is central to the network, and whether any cliques are forming. Social network maps provide a visual indication of which members are most central to the network while the statistics of network density can show how close-knit a network is. Where each node represents an individual participant, in-degree is the number of connections into a node and out-degree is the number of outward connections from a node. Betweenness centrality is a measure of the influence a particular participant has in terms of how well-positioned they are to give and receive information (de Laat, 2006, p. 86). These measures provide a way of evaluating community formation; if a network has a single centre such as the tutor, then the absence of that tutor can cause the community to fail. If, however, more than one node has a high degree of betweenness centrality, then the community may be said to be more resilient, with a lower risk of failure should one member not contribute to a particular dialogue.

Whereas the tutor was central to the network in Iteration 1, this was not the case in Iterations 2 and 3, which involved five and six student groups respectively. All members of all groups participated in these practice forums and they did so in different ways. The best illustration of this occurred in Iteration 3.

Single leader

While the tutor was not central in any of the groups in Iteration 3, one student in Group D played a similar role, suggesting ideas for consideration and encouraging others by responding to their contributions. It is interesting to note that this forum had only a single thread, suggesting greater cohesiveness of the group as well as of the dialogue. In each of the other groups leadership appeared to be shared, with varying degrees of effectiveness. This is discussed in greater detail below.

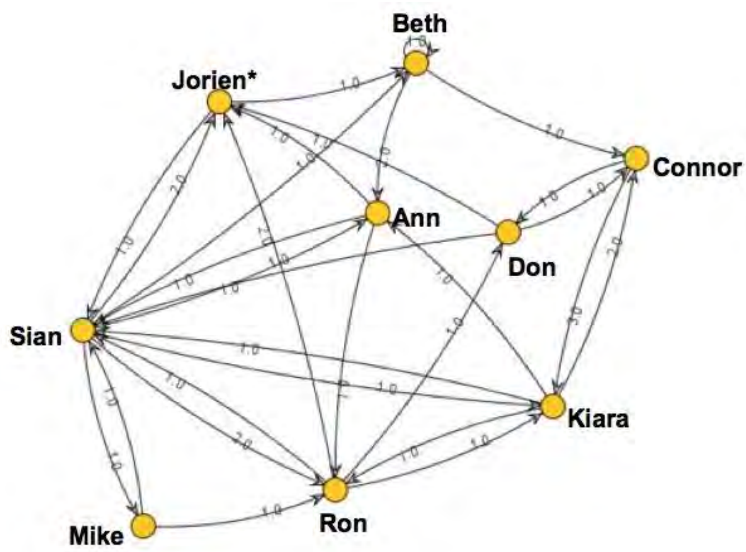

Figure 2: SNA map of Group D (* Tutor)

Although all members of Group D appeared to contribute strongly to the dialogue, the SNA map in Figure 2 shows that it was Sian who was pivotal. She initiated the thread two days before it was scheduled to start with a characteristically enthusiastic tone, "Hi group D! D for dazzling, daring, decisive and dedecated! (sic)". Although the dialogue ranged over a number of sub-topics, Sian's many short, chatty posts helped to keep it flowing. Her style was often more like speech than writing, "wow yeh never thought of that!" Each of the students' styles of writing was very different and this diversity may have been another factor in the wide range of perspectives they took and issues they addressed in the course of their inquiry. However, this group had a relatively low network density (0.36, maximum 1.0), which indicated that a focus around a single centre was not as effective for group cohesion as a distribution of the effort.

No clear leader

Nevertheless, distributed leadership did not of itself lead to greater group cohesion either. There was another factor, number of threads, and cohesion appeared to depend on the level of student participation in more than one of them. Group B's forum consisted of five threads yet there appears to have been a considerable amount of cohesion within the group as shown by its network density (0.42). Almost all of the students participated in at least three of the five threads, and discourse analysis showed high levels of coding for Addressivity and Warmth relative to other groups.

There were apparently two main reasons for the separation of the dialogue into so many threads. The first appears to have been because in general each thread represented a different topic. The two later threads occurred because of the Christchurch earthquake. One of the students was living there and as a paramedic was involved in the emergency work of the aftermath. The other reason for a large number of threads appeared to be several people taking the lead at roughly the same time. In Group B, each of the five threads was initiated by a different person, and three of them began within two days. The first two threads were both on the main topic but instead of posting a response in the thread initiated by Keith, Ashley chose to begin a new thread "… Point one from Keith's post." There is no way of knowing whether this was an attempt to organise the dialogue to make it easier for others to follow or a possibly subconscious attempt to take a leading role. In contrast, the thread "Educating the public" was clearly on a topic which was separate from the main theme of volunteers. The SNA map for all of the threads together (Figure 3 below) shows that the network centred around both Ashley and Keith, although neither of them contributed as many posts as Lily or Jorien.

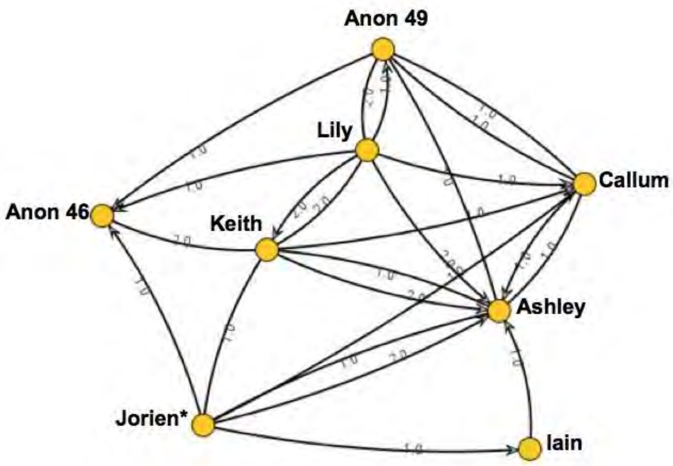

Figure 3: SNA map of Group B (* Tutor)

In contrast Group C, although their forum had only three threads, appeared far less cohesive as a community, shown by its network density of 0.26. As can be seen from the SNA maps of the three threads, shown in Figures 4, 5 and 6 below, apart from the main players, Lydia and Joss, almost none of the other group members posted in more than one thread.

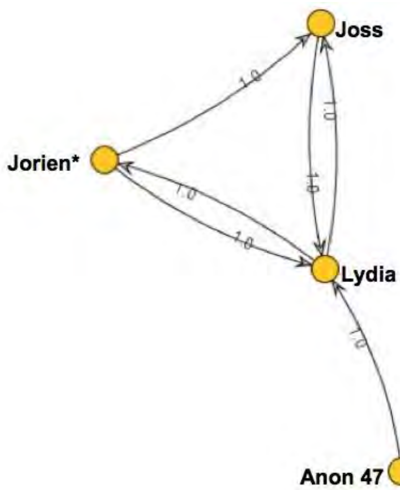

Figure 4: SNA map of Group C, Thread 1 (* Tutor)

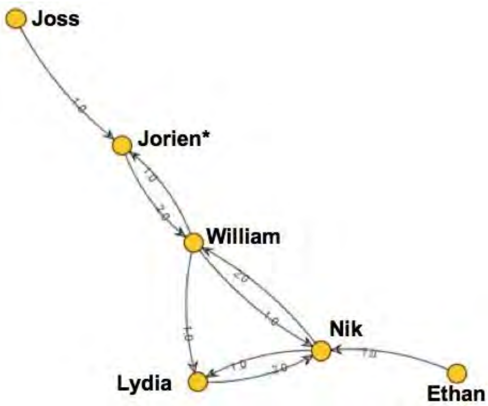

Figure 5: SNA map of Group C, Thread 2 (* Tutor)

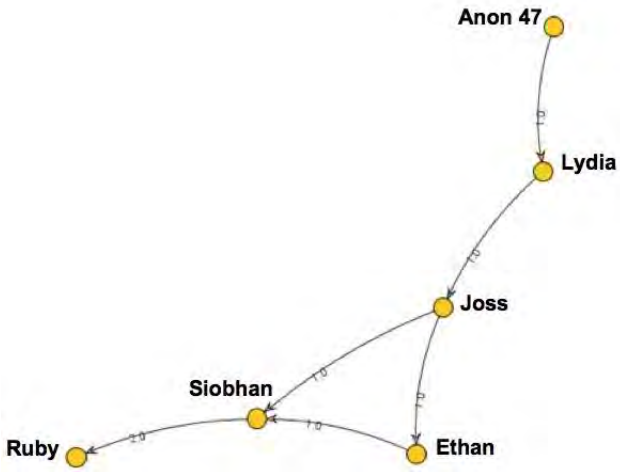

Fig. 6: SNA map of Group C, Thread 3

Again there were signs of more than one person trying to take the lead. Both of the threads labelled "Volunteers" (Threads 1 and 2 in Figures 4 and 5) were initiated within three days by two different people. This may not have been the result of a desire to lead the discussion. Many students have had the experience of losing a post after spending time composing it, and particularly at the beginning, when they are finding their feet with the topic and their colleagues, they may compose a post offline and then copy and paste it into the forum. This is essentially a much more monologic activity than reading and posting online, so perhaps it is inevitable that more than one thread will be started because they are writing, not reading.

Conclusion

The original theoretical model gave equal weight to critical, creative and community dialogue. Yet evidence from both this research study and the literature suggests that the community dimension may be fundamental, in that without it the other dimensions cannot function.

In relation to the first research question, "What are the participants saying?" the discourse analysis showed that although higher levels of addressivity and empathy, such as those found in Iteration 1, may indicate the existence of a community, a community of *inquiry* also requires students to elicit each others' views and to show respect for them through hedging. This occurred in Iteration 2 where the hedging and elicitation was matched by higher levels of critical reasoning, and in Iteration 3 where there was more dialogic reasoning.

In relation to the second research question, "Who are they talking to?" it appears that the dream of student learning communities emerging naturally as a result of their familiarity with social media is indeed a shimmering mirage. The discussion forum in Iteration 1 was very much teacher-centred and the social network analysis showed that although such a single leader may keep the dialogue going, the network density figures show that this is not necessarily enough to hold a group together. In all three iterations the intervention included work with the students to support their engagement with each other and where more than one participant did take responsibility for eliciting and responding to the views of the others, the network density figures were higher.

It appears that sharing the responsibility for ensuring that all members of a community are included in the dialogue is essential in that if dialogic engagement fails in some way, then the critical and creative dimensions of a community of inquiry also fail to thrive. This interpretation is supported by the experiences of Wegerif, Mercer, and their colleagues (2008; 2007; 2010) whose work with children influenced the focus on caring talk in the ARGUNAUT project. This is the case not only in communities of people with shared interests and backgrounds, but also in a community of people with little in common, where community dialogue accommodates for differences rather than focusing only on common interests (Davey, 2006, p. 42).

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Challenges and opportunities for growth of e-Learning enrolments: an international business perspective

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This study investigates e-Learning as a mode of university internationalisation. Drawing from business and higher education literature, trends on cross-border digital service delivery are analysed. Through a content analysis of recent strategic or corporate plans of Australian and United Kingdom universities, predictions are made about how these strategic priorities might create future challenges and opportunities for university educators and administrators. Internationalisation plans from Australian universities are also used to better understand whether e-Learning is prioritised as a current or future mode of internationalisation. Strategic and technological responses are discussed to help overcome challenges such as the trade-off between teaching quality and profitability which will become more significant as online cohorts expand.

Keywords: Online learning, e-Learning, internationalisation, international business

Introduction

Information communication technologies (ICT), especially the Internet, facilitate the processes of informing, investigating, interacting, distributing, transacting, eliciting feedback and supporting service providers and their clients (Berthon et al. 1999). The Internet can facilitate direct export channels especially where products or services can be digitised and delivered online (Morgan-Thomas and Bridgewater 2004). In higher education, ICT facilitates communication; stores and disseminates knowledge; and allows providers to offer programs through online education (Altbach and Knight 2007). Online education may ease the pressures of burgeoning university enrolments and limited campus facilities while encouraging life-long learning (Kellogg 2011).

Online education also has potential as part of a third wave of internationalisation for universities (Mazzarol et al, 2003). Evidence from Tayar and Jack (2013) and trends in student enrolments reveal however that the first wave of internationalisation involving international student recruitment is still the most significant for the sector. International student enrolments in Australian higher education institutions show only 31.3% study offshore (AEI 2011). Roughly three quarters of the 100,492 students who studied offshore in 2009 were on-campus and the remainder served through distance education including online modes (AEI 2011). So e-Learning is currently not a major export revenue earner but still may be important for onshore international students.

Competition has intensified between countries to recruit international students and there has been increased volatility and decreased predictability of overseas student flows (Woodfield 2010). In 2010 the upward trend of onshore international student enrolments ended with total enrolment numbers across all education sectors dropping but commencements in higher education increasing slightly (Deloitte Access Economics 2011). Tighter visa regulations, the strong Australian dollar, fears of racist attacks and the collapse of some private colleges are generally blamed for this poor market performance (Whyte 2011). These trends have continued to intensify and have led to negative growth in commencements (-1%) in 2011 (AEI 2013). Despite this broader decline in the sector, IBISWorld (cited in Parker, 2011) forecast significant growth in online education in Australia of 52.2 per cent over the next five years. Globally, e-Learning revenue is forecast to grow an average of 23 per cent from 2012 to 2017 (HM Government, 2013) so our sector may be headed for significant change.

A Coalition government in Australia may also further prioritise e-Learning as a mode of internationalisation. Education was flagged as one of the 'five pillars of the economy' in Liberal party election campaigning (Liberal Party of Australia, 2013). Their campaign document (Liberal Party of Australia, 2013: 10) stated that "in the education sector, we will expand our exports, particularly in the Asian region using a number of channels including online." The new Minister for Trade and Investment Andrew Robb and the new Parliamentary Secretary Alan Tudge have both expressed enthusiasm for online education by flagging the Internet as a tool for widening access available and greatly reducing costs (Moodie, 2013). Austrade (2013) has also flagged Massive Open Online Courses (MOOCs) as a 'try before you buy' opportunity for international students. In the United Kingdom, the Minister for Universities and Science in an 'industrial strategy' (HM Government, 2013: 4) claims that "explosive growth in Massive Open Online Courses (MOOCs) and their global reach has opened up a new door to education." If this enthusiasm leads to shifts in government funding to the sector and rapid online enrolment growth, university-wide strategic responses will be needed.

Preliminary literature review

The process of internationalisation is widely seen as an outward movement in a firm's international operations (Welch and Luostarinen 1988). For universities, internationalisation is defined more broadly. Knight (2004) identified four common yet distinct interpretations of internationalisation: (1) international activities such as international mobility of students and teachers; international linkages, partnerships, and research or teaching projects; (2) delivery of education to other countries through campuses or franchises involving face-to-face or distance delivery; (3) incorporating international, intercultural, or global dimensions into curriculum and teaching; and (4) an increasing emphasis on trade in higher education. This fourth perspective concerns itself with the export of higher educational services and is a controversial aspect of the internationalisation of higher education (Harman 2004).

For services exports broadly, the General Agreement on Trade in Services (GATS) defines four modes of service supply across borders. These first three modes emphasise the need for suppliers and consumers to come together in the same physical location in 'physical co-presence'. The fourth delivery mode involves cross-border flows of services between countries (WTO, 2011). These flows of services may not require physical co-presence such as with information services that are embodied in electronic media or delivered over the Internet (Baark 1999). In the same way that distance and online modes have transcended great distances in Australia, the potential for transnational delivery has significant potential in environments where the movement of students, lecturers or branches is not financially or practically feasible. Table 1 below identifies these modes for services generally and outlines common modes adopted by universities. New modes may also emerge and but as Harley (2002) suggests that the diversity and speed of change in e-Learning means that predicting new modes may be impossible.

Table 1: Examples of service delivery modes for universities

Physical co-presence	Digital Modes
• Franchises, branch campuses or delivery partnerships • International students relocating to a host market to undertake a course (international student recruitment) • Lecturers travel temporarily to deliver a whole course or block of lessons ('fly-in, fly-out')	• Online education with synchronous communications such as live lecture streaming and instant messaging • Online courses with prepared asynchronous communications such as pre-recorded materials or learning support by email • A hybrid mode using synchronous and asynchronous communications

Methods

This research analyses the strategic plans of all 39 Australian universities to understand priorities for e-Learning modes and to determine whether there is support for these modes from chancelleries. To compare Australia's priorities with other university sectors, a random sample of 72 UK universities are studied. Strategic plans hosted on Australian or UK university websites were collected and logged in a spreadsheet and then manually coded. Only documents created by the university after 2006 and labelled as a 'strategic plan' or 'corporate plan' and hosted on an official university website were included.

After an initial round of manual coding and systematic keyword searching, the methods and approach of Bradmore and Smyrnios (2009) were followed using the software Leximancer (Desktop Academic Edition - Version 3.5). Leximancer uses semantic and relational algorithms to extract information and map relationships between concepts in large corpus of text (Smith & Humphreys, 2006). Maps created in Leximancer provide "a diagrammatic view of the data, visually demonstrating how different concepts and themes are related" (Crofts & Bisman, 2010, p. 187). The documents varied in length and nature but followed similar conventions and headings. The concepts 'e-Learning' and 'online learning' were the key focus of the content analysis but other related themes and concepts were explored including MOOCs, distance education, distance learning, social media and the web or Internet generally. To see how these concepts are related to internationalisation, relational queries were used in Leximancer. To further understand the relationship between e-Learning and internationalisation, an additional set of 21 Australian university internationalisation strategies were collected from the only universities which publish these strategies and these additional documents were manually coded and then analysed in Leximancer.

Initial results and discussion

The manual coding and Leximancer concept mapping suggested that e-Learning is a strategic priority for a minority of Australian universities. Of Australia's 39 universities, 7 universities (17.9%) mention e-Learning or online learning. Of the 72 UK universities sampled, 15 universities (20.8%) mention e-Learning or related concepts in documents labelled 'strategic plans' or 'corporate plans'. Of the 111 plans, 69 plans (62.2%) were dated from 2011 or later and yet only one plan mentioned Massive Open Online Courses (MOOCs) or related terms. If 2012 was the 'year of the MOOC' (see Pappano, 2012), this is not reflected in the 45 UK and Australian plans prepared in 2012 or 2013 with the exception of the University of Adelaide which mentions MOOCs but only as a future challenge and not a strategic priority. In the internationalisation plans published online by Australian universities, e-Learning and online learning are only mentioned by 3 of the 21 plans (14.3%). This included comments such as seeing e-Learning as an area for expansion and additional budgeting (Australian Catholic University); increasing the number of online programs and student satisfaction with these programs (University of Tasmania); and supporting offshore students (University of Wollongong).

Online interaction between students of different cultures already has promise for enhancing students' "global competencies in the areas of knowledge, empathy, acceptance, foreign language ability, and intercultural teamwork." (Patterson et al. 2012: 182). Even so, the strategic or corporate plans of all Australian universities and a large sample of UK universities suggest that e-Learning is not yet a strategic priority for chancelleries. Online education may also have the opportunity to build greater legitimacy as a valid mode of rigorous study through improvements to online exam proctoring and verification. Such legitimacy-building technologies could open Australian higher education to untapped student markets. Still, the findings of this study suggest that MOOCs have yet to build internal legitimacy within universities.

Conclusions and future research

With increased adoption of the Internet and faster Internet speeds, online modes of delivery are likely to continue to grow in significance. So far, recent technological improvements and enthusiasm for online learning from governments and media have failed to significantly shape strategic plans. Even in recent planning documents, Australian and UK Universities' do not mention MOOCs as a strategic priority. If MOOCs are indeed the disruptive force they have been claimed to be, there needs to be greater strategic planning to ensure they contribute to university objectives. For e-Learning more broadly, there appears to be a relatively small cohort of universities prioritising these modes as important to their institution-wide strategies and internationalisation goals.

There are a range of challenges relating to online learning. The open and global nature of these programs is likely to create new cultural and language barriers that may exceed those already evident at highly internationalised universities. At faculty and course levels, administrators and educators may struggle to digitise courses especially those requiring specialised lab equipment or techniques difficult to record or simulate. As universities increase the scale of online programs, there will be a need for new responses to effectively manage more students and engage them with new technologies. Overcoming the trade-off between quality and profitability may involve resourcing of new tools and platforms to deliver quality outcomes at significant scale. The efficacy of these tools and platforms should be investigated in terms of both quality and profitability.

This study is limited to only identifying intentions and publically-stated priorities at the institutional level. Future studies may indicate that e-Learning and MOOCs are already being prioritised at an operational or faculty level. Currently though, the lack of institution-wide approaches suggests there may be problems aligning new online programs with university goals and budget priorities. The lack of e-Learning strategies in strategic and internationalisation plans, also suggests that universities in Australia do not have clear institution-wide plans to leverage e-Learning as a mode of export. At the student level, future studies may also seek to understand inter-mode and inter-institutional learning pathways which will become increasingly easy to understand with application and enrolment digitisation and international standardisations of student data through Digital Student Data Portability (DSDP) initiatives.

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Creating socially inclusive online learning environments in higher education

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The expansion of higher education across the broader Australian population has led to a more diverse student population than ever before. While research in the Australian context has focussed on support for some traditionally underrepresented students in a face-to-face learning context, how to enhance participation and success of these groups in online education has remained relatively unexplored. This paper presents the rationale and approach of a study investigating the challenges of students from traditionally underrepresented groups in online higher education (i.e. low SES, first in family, indigenous, disability, mature age, primary caregivers, remote and regional students, international, English as a second language), and approaches that can enhance the learning experience for these students. As a work in progress the research will draw on student and staff perspectives to develop and disseminate principles and practices for effective, socially inclusive online teaching.

Keywords: Online Education; Inclusive teaching; Social Inclusion; Non-traditional students

Research context

Within the Australian higher education environment two broad trends can be observed: the expansion of access to higher education across the population (e.g. Australian Government, 2013; Newnham, Anderson, & James, 2012), and the online delivery of courses as an alternative or a compliment to face-to-face offerings (e.g. Palmer & Holt, 2009). While a strong body of knowledge exists in effective online learning practices (e.g. Krause, 2011), much of the literature assumes that these principles apply equally to the diverse groups that make up an increasing part of the student body. Building on research into effective teaching of students from low socio-economic backgrounds in Australian higher education (Devlin, Kift, Nelson, Smith, & McKay, 2012), this research aims to explore effective teaching practices in the online space among a broader set of equity groups (i.e. low SES, first in family, indigenous, disability, mature age, primary caregivers, remote and regional students, international, English as a second language). It aims to develop an understanding of the present context relating to diversity and online learning and inform practices to further enhance practice in this area.

This paper describes a study that seeks to understand the barriers faced by non-traditional students when learning in the online context, and online teaching strategies that address the needs of a variety of traditionally underrepresented groups. Acknowledging the socio-cultural incongruence (Devlin, 2013) between university culture and the backgrounds of non-traditional students suggests there needs to be efforts to bridge this divide through inclusive teaching practices. The researchers seek to develop an evidence base of practices and principles for the design and delivery of socially inclusive online teaching to enable participation and success for all students regardless of social, cultural, economic or physical barriers. By exploring and sharing inclusive online teaching practices the research aims to support the aspirations of equity groups who can significantly benefit from educational technology.

Increasing online delivery of higher education

The trend towards increased online education in Australia can in part be attributed to government support for regional universities becoming distance education centres (Department of Education, Employment and Workplace Relations, 2010). Support for the development of technology and expertise in online education has since been expanded across all Australian universities with encouragement for collaboration and funding to increase online teaching capacity (Department of Education, Employment and Workplace Relations, 2010). Most recent statistics suggest that external and mixed-mode students represent around 20.9% of the Australian higher education market, which has been gradually increasing over time (Australian Government, 2013).

Opportunity for people to participate in online education has increased beyond single institution initiatives. Open Universities Australia represents a consortium of universities with a set of shared online offerings recognised as equivalent to on-campus units. These current trends have provided greater flexibility in access to higher education for people in situations where they would have previously not had the opportunity.

Expanding access to higher education

Attention to issues of access to higher education have been heightened since the *Review of Australian Higher Education* (Bradley, Noonan, Nugent & Scales, 2008). This has led to government commitments to expanding access to higher education (Australian Government, 2009), which have gradually increased the number of students from traditionally underrepresented backgrounds attending Australian universities, although only slightly increasing the proportions (Australian Government, 2013; Newnham, Anderson, & James, 2012). Naylor, Baik, and James (2013) suggest that the most significant factors affecting equity group participation in higher education since the Bradley review include: the uncapping of undergraduate places, the establishment of a national target for low SES participation; funding to institutions for equity initiatives; and changes in community beliefs about the value of higher education and its accessibility. Statistics from the first year of uncapped university places brought about by the *Higher Education Support Amendment* (Demand Driven Funding System and Other Measures) *Bill* (2011) suggest that in 2012 compared to 2011 commencements by:

- low socio-economic students increased by 10.4% (based on SA1 data from the 2011 SEIFA Education and Occupation index);
- regional students increased by 6.4%;
- remote students increased by 7.0%;
- indigenous students increased by 8.4%;
- domestic students from a non-English speaking background increased by 13.7%;
- students with a disability increased by 15.5% (Australian Government, 2013).

Along with these equity groups Morgan (2013) also suggests that first in family and mature aged students may face challenges in the higher education environment. Parents or primary caregivers also face considerable challenges in undertaking studies (Wainwright & Marandet, 2010). Also while the number of international students commencing in 2012 decreased (-2.7%), this group still represents a substantial proportion of the Australian undergraduate student body (27.3%) (Australian Government, 2013), who face distinct challenges in undertaking higher education (e.g. Johnson & Kumar, 2010).

Providing access is only the first step to increasing opportunity for non-traditional students. The educational aspirations of these equity groups must be supported in the design and delivery of an inclusive learning environment (Tinto, 2012). The challenges for traditionally underrepresented groups in higher education have been explored in terms of face-to-face delivery (e.g. Abbott-Chapman, 2011; Devlin, Kift, Nelson, Smith, & McKay, 2012; Morgan, 2013), however there is limited research on the experience of online higher education for these groups and strategies that may enable and enhance their participation. This research aims to address this gap through an investigation of the practices and principles of effective socially inclusive online teaching.

Research Approach

This research is underpinned by Devlin's (2013) concept of 'socio-cultural incongruence', which highlights the challenges for traditionally underrepresented students to work within the values and practices of institutions that have traditionally catered to privileged groups. This conceptual framework sets the challenge for institutions to bridge socio-cultural incongruence by re-examining their practices in the light of a diverse student body.

This research asks the questions (a) what challenges exist for students from equity groups engaging in online learning? and, (b) what strategies support learning for students from equity groups in the online environment? The study proposes to understand the student perspective on what aspects of online learning positively impacted on their learning experience and promoted participation and success in learning. This understanding will also be supported by exploring the perspective of teaching staff in supporting students from non-traditional backgrounds in online higher education. The researchers are seeking to initiate a national, cross-institutional exploration for this study so that the findings will be generalisable across different cohorts of equity groups, academic disciplines, and Australian jurisdictions. The proposal is for an exploratory sequential mixed-methods enquiry that allows the researchers to investigate qualitative data with a smaller number of participants in the first instance, then use the findings to design a second quantitative phase across a larger population (Creswell, 2014). The two phases of this research are outlined here:

Phase 1:

Interviews and focus groups will be conducted with students and teachers involved in studying or teaching online or in a blended learning environment. Participants will include (a) students from non-traditional backgrounds who have studied online or in a blended learning environment to explore the barriers to learning with technology, and practices that support learning in the online context (n=100); and (b) staff in Australian universities who teach in courses with an online component (n=50). It will be important to ensure that student participants are from a range of backgrounds (i.e. low socio-economic backgrounds, first in family, disability, indigenous, remote and regional, international, English as a second language). Also important is that student and academic participants represent a range of discipline areas, and regions throughout Australia to ensure the research has relevance to the broader Australian higher education context. Universities with a high proportion of equity student groups will be of particular interest, drawing on existing equity data. Students will be recruited through a strategy of general advertisements identifying the groups we are most interested in interviewing. Staff participants will be identified by Associate Deans of Teaching and Learning (or equivalent) as demonstrating inclusive online teaching at participating schools/faculties.

Focus groups will be conducted to facilitate critical discussion and exchange about online teaching practices and experiences of online education amongst a group of experts (Gibbs, 2012). Complimenting the audio recording of focus groups will be the use of the ZING software, which enables participants to contribute through typing out their ideas, which is projected so it can add to the focus group discussion. ZING helps to add depth to focus group discussions by making extra information available, and engaging participants in analysing data as it is being collected (Moyle, 2006). For participants unavailable for a focus group, individual interviews will be conducted, which will be audio recorded. Where participants are unable to attend an interview on campus, phone interviews will be conducted.

Interview and focus group audio will be transcribed verbatim. A coding system will be applied for a systematic approach for the analysis of the textual data (Creswell, 2014). An initial open-coding process will be conducted of each transcript to identify phenomena and concepts. From this, codes will be developed and a thematic coding process of all transcripts will be conducted in NVIVO software. A thematic analysis of the data will inform the findings of Phase 1 of the research. The perspectives of student and staff will be combined to provide a comprehensive view of effective practices (Silverman, 2011). An interpretation of the qualitative data will then inform the development of a survey instrument for Phase 2, along with a set of publicly available resources to promote inclusive online teaching practices.

Phase 2:

Findings from Phase 1 will be used to develop an online survey instrument that will collect both qualitative and quantitative data. Building on the understanding of the challenges faced by particular equity groups, and teaching practices that seem to enable these groups to participate in online learning, these surveys will seek to explore these issues in a larger sample. Two surveys will be developed, one focusing on students from non-traditional backgrounds, and one on teaching staff involved in online education.

The surveys will help to give a sense of the scale of the challenges for equity student groups participating in online higher education. These surveys will be distributed to a large sample size of equity group students (n=1500) and educators (n=500) who are studying or teaching in online or blended environments nation-wide. Data will be analysed quantitatively and qualitatively to determine effective practices and principles for inclusive online teaching in each equity group and discipline area, as well as over-arching principles. As the design of the survey will depend greatly on the outcomes of Phase 1, the design of the questions and methods for analysis will be determined at a later stage of this study. The surveys will simultaneously aim collect data, while also directing participants to resources developed from the first phase of the research.

Intended research outcomes

This research as a whole seeks to disseminate knowledge about effective teaching practices for equity student groups in online education, as well as providing a set of resources and materials to promote these practices. The dissemination strategy is an important part of the research, with significant resources dedicated to the development of a website and other resources to help raise awareness of the challenges of equity student groups in online education, and effective approaches that can be used by university teachers.

Conclusion

This paper presents the rationale and approach of ongoing research that seeks to investigate principles and practices of socially inclusive teaching in online learning environments. It aims to understand the barriers to online learning faced by students from traditionally underrepresented groups in higher education and how online learning environments can support these students to participate. This research adopts a multiphase, mixed-method enquiry drawing on perspectives of both staff and students. It seeks to increase awareness and aptitude for the design and delivery of socially inclusive online learning environments to enhance participation and success for all students in online learning regardless of social, cultural, economic or physical barriers.

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The language of science: an online animated tool for learning the vocabulary used in the health sciences

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Students often struggle with science content because of their lack of science vocabulary comprehension. Science vocabulary is often derived from Greek and Latin words, languages not familiar to the majority of our students. Knowing common suffixes, prefixes and root words can facilitate student understanding of new complex concepts. Development of a visual, interactive and quick online tool to aid students dissect and decode parts of words and help them to understand the entire word will benefit students otherwise disadvantaged, for example, students where English is not their first language and students who come to us with little or no previous science education as often the case for students undertaking the Bachelor Health Science (BHlthSci) degree. This could also help with first-year student retention as it may help students to not see science words as daunting and confusing and give them confidence in their learning

Keywords: [online tool, health science, vocabulary comprehension, moodle]

Introduction

It has been suggested that one of the biggest barriers to learning science is learning the actual language of science itself. (Wellington & Osbourne 2001). A lack of word knowledge disrupts fluency in reading and interferes with reading comprehension because word meanings can make up as much as 70-80% of comprehension (Pressley 2002). Health science, like all other sciences has a large specific vocabulary associated as well as a high density, compaction of information. For students not familiar with the jargon this can present information overload on their working memory and lead to feeling overwhelmed by the sheer density of information during text processing. Understanding word structure can be a powerful aid for students faced with learning a daunting health science vocabulary, a large number of these words could be understandable if students knew some of the more common root words and be able to break the word down into component parts (Nagy and Anderson 1984)

Effective word learners break down unfamiliar words into constituent meaningful parts, they then hypothesise their meanings and then check against the context of the text they are reading the word in, by doing this they are using their knowledge of high frequency root words to access low-frequency words. It has been well established that knowing a word means not just knowing its definition but also its relationship to other words, the meanings in different contexts and how it can be transformed into different forms (Stahl 1999). The reader’s knowledge and meaning of words and concepts are central to their success, with vocabulary linked to proficiency in reading comprehension. A commonality for many of the science terms is their derivative origins from Greek or Latin basis root derivatives. Knowing the meaning of a number of core root derivatives can greatly aid comprehension and make learning a health science subject more accessible.

In their paper on breaking down words to explore meaning, Kieffer and Lesaux (2007) describe key principles for teaching morphology; this is the structure of words with morphemes being the smallest units of meaning. These principles include:

- Teaching morphology in the context of rich explicit vocabulary instruction, this means repeated exposures to words and in meaningful contexts to stimulate an awareness of and interest in words and their meanings.
- Teaching students to use morphology as a cognitive strategy with explicit steps; so to recognise that a word is unknown, analyse word for morphemes, hypothesis the words meaning and then check against the context the word is given
- Teach underlying morphological knowledge needed both explicitly and in context; knowledge of prefixes and suffixes, how words get transformed and knowledge of roots

Mountain (2005) describes that morphemic analysis may be one way to narrow the gap between vocabulary 'haves and have not's'. Understanding the root of a word can help immensely with the comprehension of a science word, i.e. knowing cardio relates to the heart, rhino relates to the nose. Kail (2008) reports how teaching root words to students in an English class facilitated students comprehension in other areas, particularly the sciences. A key to successful vocabulary instruction is to get students engaged in interactive word-learning experience (Harmon 2002) and that which focuses their attention on learning clusters of words that share a common element/origin (Hennings 2000).

It is the case that our student population is becoming increasingly diverse in demographic and with this comes a more diverse base knowledge. A large and rapidly growing proportion of tertiary students in NZ are English language learners and simply lack English vocabulary to comprehend difficult texts. Manzo et al (2006) report a decline in vocabulary levels of college bound 18-year olds and at the 100-level there are also students with little or no prior science background, or those who are re-entering into study after a long period of time. Therefore great differences exist between individual vocabulary levels of students taking a paper at any given time, part of our role as educators is to try to level this disparity and facilitate learning strategies for those students with a more limited vocabulary.

Aim

To develop a highly visual, online tool to embed in the stream (Moodle) online learning environment to facilitate recognition and learning of root words commonly found in BHlthSci 100-level papers; 214102:Applied science for health professionals and 214101: Normal body function . The aim of this tool is to focus on the relationship between learning vocabulary and reading comprehension, that growth in vocabulary knowledge and comprehension occurs more from seeing words in context rather than defining words in lists.

Methods

The teaching team (who are all heavily involved in the teaching of the 100-level BHlthSci papers on three campuses) initially developed a list of key scientific terms that are used in the 100-level health science papers. This list of words formed the basis of the initial tool developed. The initial tool was circulated around departmental teaching staff for input and feedback on additional roots and words to include. The tool was developed as a PowerPoint presentation comprising text and graphics imported from Clip Art and on continuous loop, initially at 6 seconds per slide with a pause function. This was integrated into the student's Moodle learning environment for the paper as a 'pop-up' that the students could interact with. In addition the PowerPoint file was converted to a Flash Video (.FLV) format using the Xilisoft PowerPoint to Video Converter Free1.1.1. The video was then embedded in the Moodle online learning environment for the Applied Sciences for Health Professional site.

Outputs

The tool was developed as a PowerPoint presentation on continuous loop that was integrated into the student's moodle learning environment for the paper. It is also available for the students to open up as a separate entity and engage further with the tool if so desired. The tool is divided up into alphabetic categories and then commonly used roots in each category are demonstrated visually alongside basic definitions of terms commonly used in the health science papers. The key is to make it clear, simple and visual to aid memory by association of the words with the visual representations. The roots are grouped alphabetically on a title slide (see Figure 1 for example) for ease of navigation and hyperlinked so students can navigate the tool easily, if they so wish. For each of the initial 70 core root derivatives there is a separate slide with a pictorial representative and word descriptor of the root meaning as well as several applications and brief definitions of the root in the context of the health sciences papers taught at 100-level to the B Hlth Sci students (Figure 2). Additionally there is also the facility for the students to open up the tool as a separate entity in PowerPoint and engage further with the tool if so desired. The tool is seen as an evolving application, and an 'add word' function is also present so students can enter suggestions for inclusion of words that they find difficult to be incorporated in the tool. The Stage 1 roll-out of the tool was for the 100-level paper Applied Sciences for Health Professionals in Semester 2 July 2013, with more than 300 students enrolled. Stage 2 roll-out after student feedback will be summer school November 2013 and Semester 1 2014 for students taking the Normal Body function paper, again with more than 300 students enrolled).

Figure 1. Screen shot of root derivative top slide G-J

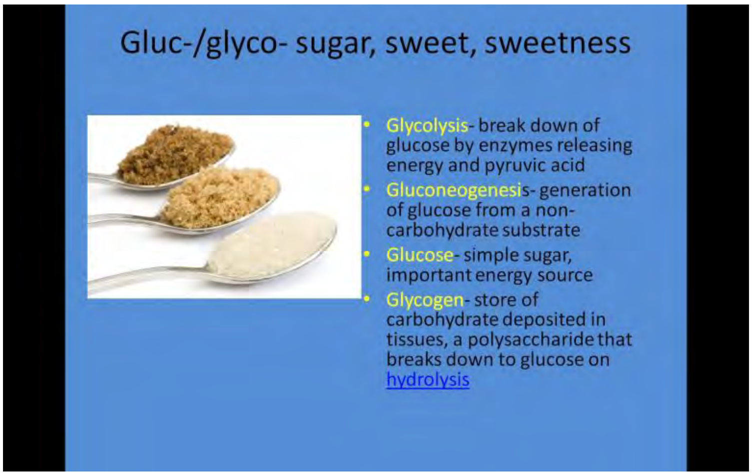

Figure2. Screen shot of an example of a root derivative with pictorial representation and Health Science contextual description

Conclusion

This paper reports the development of a simple tool designed to enhance student learning through the improvement in comprehension of basic health science vocabulary. The tool has been integrated in the Moodle online learning environment as a 3 minute video and as a function that can be downloaded and interacted with on slower time. Student usage will be monitored over the next year and a question relating to students perceived the usefulness of the tool will be incorporated in the end of paper surveys. This tool is now available to all 100-level health science students taking the applied science paper and will evolve in response to student input and feedback.

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Joining the dots: using structured e-portfolio assignments to enhance reflection

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Although there has been an increased interest in the use of electronic portfolios in higher education over the last five years, relatively little is known about the potential of such tools to support the development of higher order abilities for students, such as reflection, in a structured way that is suitable for assessment. This paper reports the findings from a small-scale research which sets out to compare the outcomes of reflective assignments in two cohorts of participants in a Postgraduate Certificate in Professional Practice in Higher Education in the UK. Participants in the programme were asked to submit reflective accounts using an e-portfolio system as part of their formal assessment. One cohort completed the assessment using some generic guidelines of how to reflect and construct an e-portfolio page without a given template or structure, whereas another cohort was given a specific template with clear assessment criteria to gauge the assembly of their reflections. The authors, who are also tutors in the programme, analysed the submitted reflections following open coding procedures. The analysis found a tendency for the reflection in the first cohort to be merely descriptive without progressing to speculating objectively about answers to relevant analytical questions about the process involved in the ability under scrutiny. In contrast the assignments of cohort two were found to be more insightful in terms of assimilating random bits of materials, thoughts and self-questions into complete reflective accounts. These findings bring some evidence to support and indeed promote a more structured approach to reflective practice, which can be further enhanced through a carefully created e-portfolio template and associated assessment criteria.

Keywords: reflective practice, e-portfolios, assessment criteria, templates

Learning how to learn in a professional context

If participants in professional teacher training courses are to make the most of their opportunities to develop higher order abilities, then they too will have to adapt to new learning contexts and perhaps acquire a new skill of "learning to learn" (e.g. Brandes and Ginnis, 1986). There is still a lot of debate within this area as to the nature of adult learning skills (e.g. Hattie, Biggs and Purdie, 1996) and the role of reflection. However, one agreed factor is the need for learners to reflect on the process of learning. Reflection is becoming a dominant theme in study skills work and in the design of courses - including the use of reflection journals (Moon, 1999), often submitted in e-portfolios. Most of the models and frameworks of reflective practice are highly influenced by the work of Donald Schön (1983). A useful framework for describing the experience of learning, that includes reflection, is the Kolb Experiential Learning Cycle (Kolb, 1984).

In theory, this cycle may begin from experience or generalisation. More commonly the cycle begins from an experience on which the learner reflects, and through reflection creates a generalisation about what has been learnt.

The learner should plan to test out any generalisation in active experimentation, constructively seeking both confirmation and counter examples in the next experience; and so the cycle progresses. However, instead of having learners going through the various stages of reflection in an abstract way (i.e. simply following a model or framework of reflection to make them think 'reflectively') other scholars such as Boud (1988) , Cowan (2006) and more recently Coulson & Harvey (2013) suggested a more structured reflective approach. The structured reflective approach can be facilitated to engage the learner with self-evaluations of the quality of their reflections. An early step towards self-evaluation can emerge when learners are prompted by the tutor's guidelines to move further into their Zones of Proximal Development (Vygotsky, 1978). The self-evaluation aspect of development can be strengthened if the teachers provide adequate and appropriate structures for reflection (Moon,1999; Vlachopoulos and Cowan, 2010). It is a question of this paper whether e-portfolios can effectively facilitate such approaches to self-evaluation of reflective thinking.

The study

The work reported here aims to investigate the difference between unstructured and structured approach to reflection with an overall aim to inform the design of suitable e-portfolio structures and associated assessment criteria. The design of the e-portfolio structure and assessment criteria can facilitate the development of higher order abilities on the part of the participants in the Postgraduate Certificate in Professional Practice (PGCPP), which is organised and delivered through the Centre for Learning Innovation and Professional Practice at Aston University in Birmingham, UK. The PGCPP programme comprises three twenty-credit core modules (similar to the Australian programme units) and is delivered in blended learning format, which includes a number of 'taught' days (residential and away days), lunchtime seminars and the use of a Virtual Learning Environment (also referred to as Learning Management System) and an e-Portfolio platform (PebblePad). Two cohorts of participants took the PGCPP core module "Delivering a High Quality Learning Experience" during academic year 2011-2012. Both cohorts were required as part of their assessment to reflect upon and analyse their experiences of attending the residential and the away day, making sense of related literature over the course of term and developing themselves as teacher practitioners through their involvement in academic teaching. The first cohort (no=18) worked towards the completion of the reflective task in an unstructured way, meaning that they were introduced to Kolb's Cycle and were advised to use it to create their reflective assignments in the e-portfolio. The second cohort (no=12) worked in a structured way, with a given e-portfolio template (which they could modify) and set assessment criteria (Table 1). The different assessment structure for the two cohorts provided the opportunity for valuable comparison of the experiences in the two distinct approaches. Both cohorts submitted their reflective accounts using PebblePad. Ethics approval was given by the University's Educational Research Ethics Committee.

Criteria	**Distinction**	**Pass**	**Fail**
Self-scrutiny	Demonstrates an *open, non-defensive ability to self-appraise*, discussing both growth and frustrations as they related to learning in class and online. Risks asking probing questions about self and seeks to answer these.	Sometimes defensive or one-sided in the analysis. Asks some probing questions about self, but do not engage in seeking to answer these.	*Little or no self-scrutiny, minimal risk* in connecting concepts from class to personal experiences. Self-scrutiny tends to be superficial and factual, without self-reflection.
Connection to experiences	*In-depth synthesis* of thoughtfully selected aspects of past and current experiences (either as a learner or a teacher) related to your practice in your institution. Makes *clear* connections between	Goes into *some detail* explaining some specific ideas or issues from experiences related to the practice. Makes *general* connections between what is learned from outside experiences and	There is no attempt to connect *general ideas* or issues from experiences with the issue under scrutiny.

	what is learned from experiences and their own current practice.	their current practice.	
Connection to readings & other resources (assigned and ones you have sought on your own)	*In-depth synthesis* of thoughtfully selected aspects of readings and other resources related to the experience under scrutiny. Makes *clear* connections between what is learned from readings and the experience. Includes reference to at least four different readings other than those readings assigned for class.	Goes into more detail explaining some specific ideas or issues from readings related to the experience. Makes general connections between what is learned from readings and the experience. Includes reference to at least two readings other than those assigned for class.	There is no attempt to connect *general ideas* or issues from readings or other resources with the experience or issue under scrutiny.
Connection to class discussions & course learning outcomes and planning of active experimentation	Synthesize, analyze and evaluate thoughtfully selected aspects of ideas or issues from the class discussion as they relate to each experience under scrutiny. An excellent attempt to plan an action for improving learning and teaching in context.	Synthesize clearly some directly appropriate ideas or issues from the class discussion as they relate to the experiences discussed. Some attempt to plan an action for improving learning and teaching in context.	Restate some general ideas or issues from the class discussion as they relate to the experiences under scrutiny but there is no attempt to synthesize them or translate them into action.

Table 1: Assessment Criteria for E-Portfolio Reflective Assignments

Methodology

A semi-qualitative approach was adopted to collect data to help categorise the type of reflection reported by the participants. A coding scheme was developed by the authors to measure the type of reflection. The content analysis was based on the four main stages of reflection (Kolb, 1984). Our system has four broad categories (Reporting an Experience, Reflecting on Experience, Generalising from Experience, and Planning an Action). The reflective accounts submitted in PebblePad were segmented into 115 (for Cohort 1) and 172 (for Cohort 2) 'meaningful units', following a methodology developed for Verbal Data Analysis (Chi, 1997). The difference in the number of segments can be justified if one takes into account the difference in the number of participants in each cohort and hence the number of total submissions. The coding unit in this case was the 'syntactic unit' (e.g. sentence, paragraph). Each paragraph of the reflective account was segmented into sentences, which were then coded into one of the four main categories. All data coding and qualitative analysis was done using NVivo 8 and some data summarisation was carried out using Excel 2007. Inter-rater reliability was used to check the reliability of the coding with a Kappa agreement rate of 61% achieved between the two coders of the data.

Findings

There was a difference in terms of how much and at what level of depth participants in the unstructured (Cohort 1) and structured (Cohort 2) task arrangements reflected, with Cohort 2 participants contributed almost three time more comments coded under the ‘Reflecting on Experience’ code, as shown in Figure 2. Having traced back the changes made in the e-portfolio submissions it became clear that most of the deep self-questioning in Cohort 2 may have occurred as a result of the effective use of the given template in that it scaffolded more aligned connections between disparate thoughts and resources. In addition to this, we found some qualitative differences in the way that participants in the two cohorts approached reflective analysis. Participants in Cohort 2 expressed a greater number of feelings and exercised self-questioning, whereas participants in Cohort 1 were more oriented towards making claims and stating facts and evidence from the literature.

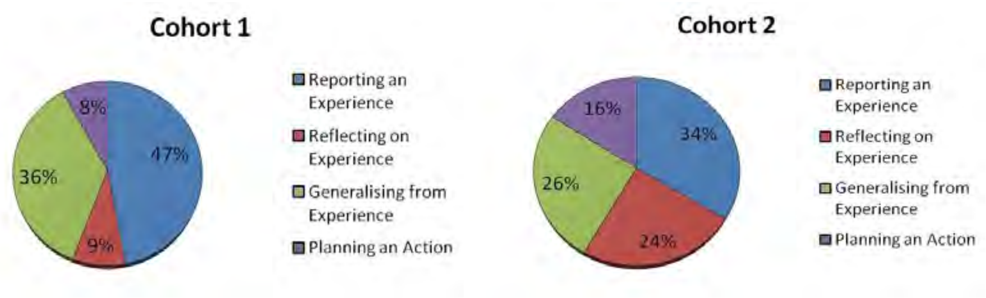

Figure 2: Reflective activity in the unstructured (Cohort 1) and structured (Cohort 2) paradigm

Implications for practice

The use of e-portfolios lends itself well to both unstructured and structured approaches to reflective practice. We argue in this paper that there seem to be some scope in promoting the latter approach and in particular giving participants templates to help them join the, often disjointed, dots of reflective journeys. It is imperative that careful consideration should be given in the design of assessment criteria, especially those that aim to develop the meta-cognitive conditions in which the mind can assimilate random bits of material, including those that have often been gathered serendipitously, from readings, conversations and experiences (Rose, 2013). E-portfolios can certainly help to join the dots of a reflective journey together as they provide the space and necessary tools for users to synthesise their thoughts. As reflection is a way to move from one place and space in another, the use of a well-considered e-portfolio structure and associated assessment criteria enables reflection to be practiced and documented more purposefully and systematically.

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Embedding Professional Skills in the ICT Curriculum

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This paper reports on a preliminary investigation into the technology and techniques for designing and managing higher education programs in Information and Communications Technology (ICT). The approach outlined is based on the Skills Framework for the Information Age (SFIA) and is informed by data arising from the Australian Computer Society (ACS) Computer Professional education Program (CPeP). It is intended that this work will inform subsequent research to improve dialogue between Industry Advisory Boards, Professional Societies, and their academic partners as they design, implement, and accredit higher education programs in ICT. It is further intended that this will contribute to the development of ICT curriculum that is aligned with industry expectations and prepares ICT graduates for professional practice. Future directions for improving SFIA based curriculum design and facilitating better stakeholder communication and collaboration are discussed.

Keywords: ACS, SFIA, skills, competencies, portfolio, badges, accreditation

Introduction

The Skills Framework for the Information Age (SFIA) is a standardised approach for defining Information and Communications Technology (ICT) skills and the level of autonomy and responsibility at which ICT professionals practice them (SFIA Foundation, 2011). In particular, the framework defines generic skills plus an additional 96 ICT skills that are classified hierarchically by category and sub-category. Further descriptors are defined that indicate the levels of autonomy and responsibility at which skills are practiced based on a seven-level scale. Level 1 denotes that a skill is practiced in a manner in which an individual follows others. At the other end of the scale, Level 7 denotes that a skill is practiced with a high level of autonomy and responsibility in which the ICT professional sets strategy and inspires and mobilises stakeholders.

The Australian Computer Society (ACS) uses SFIA as the basis for the certification of ICT professionals in Australia. ACS requires that Certified Professionals operate at SFIA Generic Level 5 (ACS, 2012a). At this level, ICT professionals demonstrate a high standard of practice and advise stakeholders on a range of items including design alternatives, scope, and standards. The ACS further requires that Certified Professionals demonstrate in-depth knowledge of ICT skills at SFIA Level 5 in a given specialism, in addition to possessing the breadth of ICT knowledge defined in the Society's Core Body of Knowledge (CBOK) (ACS, 2012b). It is also necessary for Certified Professionals to undertake 30 hours of professional development annually to maintain professional certification. Professional development hours are logged electronically by ACS members and linked to SFIA skills and levels on the ACS web site.

There are several pathways leading to Certified Professional status (ACS, 2012a). One of these is graduating from a higher education program accredited by ACS or a regional authority that is a signatory to the Seoul Accord, in addition to working in the ICT industry for 18 months following graduation and successfully completing the ACS Computer Professional education Program (CPeP) (ACS, 2012a). This postgraduate program embeds the development of SFIA skills at Levels 5 and 6 and is a key element of the course design.

Background

Skill frameworks and competency standards similar to SFIA are well defined by many professional bodies (CPA Australia, 2004; Engineers Australia, 2013; Nursing and Midwifery Board of Australia, 2013). Such professional competencies have been mapped to higher education curriculum, institutional graduates attributes, and the assessments used to measure their attainment (Merritt, Blake, McIntyre, & Packer, 2012; Oliver, 2013). Rather than being a tic-the-box exercise, embedding professional skills and competencies into the curriculum should be done as part of a holistic educational design. In the case of ICT, for example, it has been argued that SFIA should shape learning activities and assessments that provide for the practical application of skills (Bailey, 2012). However, few publically available examples exist to demonstrate how this can be achieved.

While curriculum mapping for professional competencies generally takes a tabular format (Bailey, 2012; Oliver, 2013), some preliminary work has been undertaken to explore how SFIA skill sets can be visualized graphically. For example, von Konsky, Hay and Hart (2008) used spider diagrams to visually compare the intended SFIA skills developed by undergraduate degree programs and the level at which they are practiced to that of entry level positions in industry. Similarly, Armstrong (2011) used a square grid containing SFIA skills, with each grid cell colour-coded to represent SFIA levels. This was done as a means to visually compare the suitability of candidates for available positions against selection criteria that were similarly coded.

Increasingly, students are using e-Portfolios to collect and reflect on artefacts related to the development of professional skills and graduate attributes (Hallam, 2009; Jones & Lindley, 2010; Oliver, von Konsky, Jones, Ferns, & Tucker, 2009). It has been argued that a personal portfolio containing artefacts generated by an applicant is the only truly authentic competency measure (Palmer & Ferguson, 2008). However, these must be unpacked and vetted against a framework to demonstrate alignment with specific professional skills. Digital badges are an emerging technology that may significantly impact this. With badges, a trusted authority can unpack and vet an e-Portfolio against a framework such as SFIA. Based on this, the e-Portfolio holder receives digital badges that are linked to an authenticating server to verify skill attainment in electronic resumes and *curricula vitae* (Phelan, 2012).

SFIA in the ACS Computer Professional Education Program

ACS Members are eligible to enrol in CPeP which embeds SFIA, during which they complete a *Professional Practice* component in addition to three core subjects and an elective (ACS, 2013a).

For example, students reflect on attainment of SFIA skills under the guidance of a mentor over a period of up to 52 weeks. During that time, students maintain an e-Portfolio and an online reflective journal (Jones & Lindley, 2010). The journal represents an opportunity to reflect on CPeP learning activities and consider how these will inform future practice as an ICT professional. The e-Portfolio is used to store artefacts demonstrating attainment of the intended learning outcomes, and forms the basis of a student self-assessment against the SFIA generic skills. Each student's mentor evaluates the self-assessment to confirm the generic SFIA level identified by the student. The use of digital badges is currently under consideration. If implemented, this could be used by students to attest to attainment of SFIA skills using software available on the Moodle Learning Management System based on Mozilla Open Badges (Moodle, 2013; Mozilla Foundation & Peer 2 Peer University, 2012).

Similarly, specific SFIA skills are embedded into core and elective subjects (ACS, 2013b). For example, an elective subject called *Green Technology Strategies* develops specific SFIA skills in the context of environmentally sustainable technologies (Worthington, 2009). The specific SFIA skills developed in this subject are: Emerging Technology Monitoring, Business Process Improvement, Strategic Application of Information Systems, Procurement, and Conformance Audit.

The authors are currently analysing SFIA data from CPeP and conducting interviews with graduates to ascertain the work readiness of early career professionals as a component of a larger funded research project. This project will also consider further tools and technologies based on SFIA to enhance the design and management of ICT higher education programs that engages all stakeholders.

A Model for Embedding SFIA into the ICT Curriculum

Based on the authors' experience with SFIA and CPeP and given preliminary results arising from this study, a broad model for embedding SFIA skills into the ICT curriculum is depicted in Figure 1. This model will be further elaborated as a result of workshops and focus groups involving ICT educators and industry representatives in conjunction with this research project. The preliminary model involves a feedback loop with four stages.

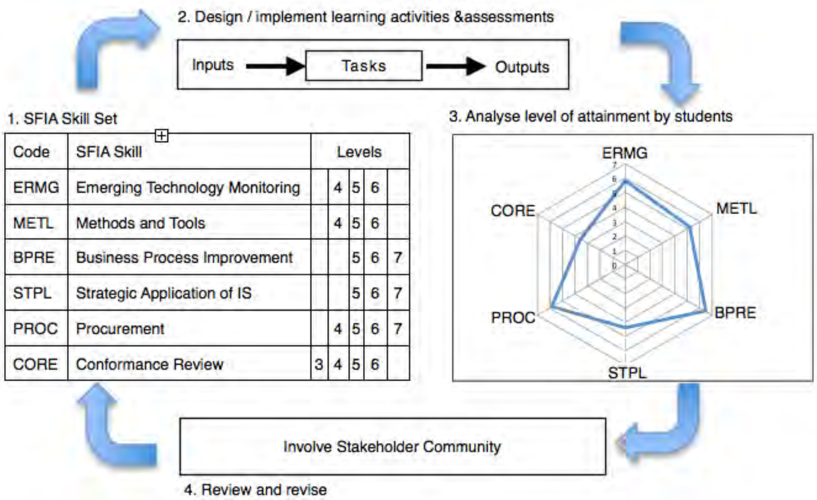

Figure 1: Using SFIA in designing and communicating higher education programs

Stage 1: Identify the SFIA skills set for each unit in the context of the subject content. Consider the design of a hypothetical new unit on green ICT broadly based on the CPeP *Green Technology Strategies*. Six specific SFIA skills for the unit are shown in Figure 1, along with the levels for which each skill is defined in the SFIA framework.

Stage 2: Design and implement learning activities and assessments that develop the identified SFIA skills. This can be facilitated by a noun and verb analysis of the SFIA skill descriptors. An analysis of verbs in the descriptors suggests tasks. Nouns are related to the inputs into and outputs from learning tasks.

For example, the SFIA Skill Descriptor for the Emerging Technology Monitoring (ERMG) skill is shown below, modified to identify relevant verbs in bold and nouns in italics (SFIA Foundation, 2011):

> The **identification** of new and emerging *hardware*, *software* and *communication technologies* and *products*, *services*, *methods* and *techniques* and the **assessment** of their *relevance* and potential *value* as business enablers, improvements in cost/performance or sustainability. The **promotion** of emerging technology *awareness* among staff and business management.

This skill does not explicitly refer to green technologies, but is none-the-less directly relevant to a unit on green ICT. In that context, the noun-verb analysis suggests three formative learning activities involving the identification, assessment, and promotion of green technologies within a business. Potential activities leading to a range of artefacts suitable for inclusion in e-Portfolios that demonstrate attainment of this SFIA skill could take many forms. Student reflections in the e-Portfolio place these artefacts into context and consider how they will inform future behaviour and beliefs. It is natural to consider that learning activities should lead to written reports. Written analyses and recommendations are authentic in the sense that they are often fundamental in setting business strategy and policy. However, they do not necessarily demonstrate other attributes of an ICT professional, including relevant teamwork and communication skills. Potential learning activities and artefacts for the hypothetical unit in this example include: 1) discussion forum brainstorming on green computing issues based on workplace experience and other sources, leading to a collaborative wiki summarising findings; 2) a written report containing an analysis of introducing green technologies for a hypothetical business; 3) oral presentations in which speakers champion the benefits of adopting green ICT technologies. These tasks produce a range of formats well suited for inclusion in student e-Portfolios. These include links to the wiki showing outcomes from brainstorming and collaboration, reports containing written analysis, and oral presentations captured on video.

Adopting green technologies would also likely involve business change and impact procurement. This suggests that further design iterations are appropriate to consider combining other SFIA skills into planned learning activities.

Stage 3: Analyse student attainment of SFIA skills. Learning activities should be designed to target specific SFIA levels. For example, CPeP generally targets SFIA level 5 or 6. An analysis of student reflections and learning artefacts should be conducted to determine the extent to which the intended objectives have been met. This analysis can be conducted visually as described by von Konsky, Hay and Hart (2008) or Armstrong (2011).
Stage 4: Review and revise the curriculum. Developing ICT as a profession requires the involvement of all stakeholders (von Konsky, 2008). While they should be involved throughout the design, implementation and review of higher educations programs, it is particularly important to involve them when reviewing and revising the curriculum. It is indicated that SFIA has the potential to promote effective communication amongst stakeholders, and will be the subject of further research by the authors.

Conclusions

This paper has identified a preliminary strategy for embedding SFIA into the ICT curriculum with the intention of producing work ready graduates who are prepared for initial practice as ICT professionals. The strategy makes effective use of tools and technologies to support ICT education, particularly focused on providing a common framework and nomenclature based on SFIA. The work described will lead to subsequent research involving recent CPeP graduates, representatives from industry and academia, and envisions a future where the roles of emerging ICT professionals is shaped by higher education institutions in partnership with relevant stakeholders.

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Wiki-based interventions: A curriculum design for collaborative learning

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This paper reports on the first phase of a wiki-based project in higher education in Thailand. The wiki innovation was focused on promoting collaborative learning. Previous literature on wikis shows that merely using a wiki, without teachers' support and without critical consideration of the approach to teaching and learning, does not impact significantly on the nature of student collaboration and hence on learning. This paper discusses the nature and value of the design based research for the development of interventions implemented in the wiki project to promote collaborative learning. These interventions focused on shifting thinking, learning and knowing in designing activities which responded to practical problems of wiki use. Discussion is provided on the benefits of design based research, and in particular the interplay between teacher and learner that impacted on the design for students' collaborative learning.

Keywords: Wiki, interventions, collaborative learning, design based research

Introduction

The nature of wikis as a Web 2.0 application allows multiple users to jointly create and edit shared information on wiki pages. The educational use of wikis has been recognised, and has been implemented increasingly in higher education to promote collaborative learning (Guo & Stevens, 2011; Pifarré & Staarman, 2011). Wikis allows users to develop a shared group project, encouraging a belief that a wiki can enhance social interactions and particularly peer-to-peer collaboration, improving learners' critical skills in writing, editing and refining of their learning (Mason & Rennie, 2008), and in addition developing essential attributes of graduate students that are valued in the workplace (Hernández-March, Martín del Peso, & Leguey, 2009).

While wikis offer such potential for enhanced pedagogical environments, they also pose challenges to learners and teachers (Waemusa, 2011). Learners, for example, need to be aware of and to be trained with the skills in building knowledge collectively through the process of shared and distributed authorship (Davies & Merchant, 2009). In order to address these skills, students require prior training in techniques for collective work (Ramanau & Geng, 2009). It follows that the collaborative construction of knowledge is not a learning experience that can be left to develop spontaneously, or organically. Design of the wiki space and use allows for intentional collaborative experiences. For instance, the collaborative process might need to be designed to require active contributions from members (Jacobson, 2008). In addition, wikis may be challenging to teachers. To use wikis in educational practice, teachers may need to change their roles to, in particular, focus on the role of facilitator and moderator in a collaborative learning environment (Wheeler, Yeomans, & Wheeler, 2008). These roles require a well-organized design activity which, it is argued here, supports the development of new learning technology through the inclusion of student, tutor and course designer perspectives in the design of the learning environment.

This paper is part of the study which examined how a wiki can promote collaborative learning in Thai higher education. The research context was *Cross-Cultural Communication*, a compulsory course for third year students majoring in Language for Development programme at the Faculty of Liberal Arts, Prince of Songkla University in 2012. In a blended learning environment, the students were required to post their group project on the wiki in Moodle, the university learning management system (LMS). In this study, the choice of using Moodle wiki was influenced by the institutional preference. Like other wikis in different platforms, the Moodle wiki has some basic functions but provides manageable tools for course designers (Cole & Foster, 2008) to design the learning environment with flexible interventions on the same platform such as an integration of different communication tools (i.e. Chat and Forum) in offering choices of interaction spaces for learners.

The focus in this paper is to explore the connection between the design and the research of the course by explaining the key interventions that were designed and implemented in order to grow the collaborative learning environment. First, the paper identifies the nature and purpose of design-based research (DBR). It then applies the process of DBR in the identification of practical problems of wiki use in promoting collaborative learning, and identifies possible solutions. The paper finishes with thoughts on the value of DBR for the development of the pedagogical interventions.

Design-based research

To design the learning environment driven by collaborative learning, teachers can incorporate a DBR approach into their practice. DBR involves theory-driven design of learning environments with implementing interventions in authentic settings (Design-Based Research Collective, 2003).

DBR as a research approach can help teachers to develop possible interventions of wiki use in enhancing collaborative learning by emphasising the learning context in wiki use (Naismith, et al., 2011; Ruth & Houghton, 2009). Based on the work of Brown (1992) and Collins (1992), DBR is a research approach which incorporates “empirical educational research with the theory-driven design of learning environment” (Design-Based Research Collective, 2003, p. 5). It can help teachers to identify and understand “knowledge about developing, enacting, and sustaining innovative learning environments” (Design-Based Research Collective, 2003, p. 5). Furthermore, DBR enables teachers as both researchers and practitioners to work in authentic settings while proposing design principles for future implementation (Reeves, 2000, p. 12). With the implementation of interventions in the learning context in order to augment collaborative learning, teachers can benefit from DBR by gaining insights of collaborative learning through learners’ experience of wiki use.

As such, the value of DBR becomes evident because it can help teachers understand “how, when, and why educational innovations [with wiki use] work in practice” (Design-Based Research Collective, 2003, p. 5). Judd, Kennedy, and Cropper (2010), for example, found that providing a wiki space for learners did not ensure that collaborative learning would take place among learners. They suggested a crucial role of a teacher in designing a curriculum and facilitating learning processes in a wiki-learning environment. A study of a DBR developed wiki learning space proposed that the learning context should be addressed to enhance collaborative learning (Naismith, Lee, & Pilkington, 2011). They found little evidence of collaboration in the wiki because students worked collaboratively using other technologies and offline.

A curriculum design: A focus on the collaborative learning context

An underlying principle of a curriculum design essential for enhancing collaborative learning effectively is the learning context with the focus on process-oriented interaction (Ruth & Houghton, 2009; Naismith, et al, 2011). Such orientation requires DBR in the curriculum design with the interplay between teachers and students. In their study of wiki use in higher education in Australia, Ruth and Houghton (2009) examined how students conceptualised wiki use in a classroom environment to complete a research project. Wiki implementation, they argued. needs to pay attention to the principle of how we come to know something to make sense of the world. In other words, to implement a wiki, teachers need to focus on the “interacting with learning processes” (p. 135) for knowledge construction rather than the body of the knowledge. Thus, wiki implementation should adopt a more complex understanding “of *thinking, learning and knowing* [emphasis added]” (Ruth & Houghton, 2009, p. 135) to facilitate collaborative learning. Following Ruth and Houghton (2009), wikis require joint interaction of teachers and learners to think, act and know during wiki use; and in addition teachers need to focus on group interaction processes rather than individual performance.

Through the lens of DBR principles which connects learning theory, design artefact with practice, practical problems from previous wiki-based studies were analysed and filtered to design possible interventions as solutions to learning conditions that are productive as the learning theory suggests (Design-Based Research Collective, 2003). The results are shown in Table 1 below.

Table 1: Practical problems in wiki use and possible interventions

Practical problems	Possible interventions
Holding conventional ideas: not knowing the nature of collaborative learning (Wheeler, et al., 2008), mismatched learning attitudes for wiki use (Grant, 2009).	To provide a prior orientation (An, 2010; Wheeler, et al., 2008); to encourage learners to adopt positive attitudes towards wiki use (Guo & Stevens, 2011) by raising students' awareness about the wiki nature prior to their use (Wheeler, et al., 2008)
Technical problems: a lack of digital skills, not directly transfer digital skills to the academic setting (Ramanau & Geng, 2009)	To give a prior training (Ramanau & Geng, 2009), e.g. 'sandbox playing'(Gee, 2005), exploring the wiki functionalities together
Low level of active participation (Grant, 2009)	To give hard and soft scaffolding (An, 2010); to facilitate collaborative process (Jacobson, 2008) by providing and encouraging communication during interactions (Su & Beaumont, 2010); To provide negotiating mechanisms as reciprocal scaffolding among learners, e.g. using sentence openers (Pifarré & Staarman, 2011); to integrate a wiki activity with assessment (Judd, et al., 2010); to integrate with asynchronous and synchronous communication tools (An, 2010; Pifarré & Staarman, 2011; Su & Beaumont, 2010)
Activities performed in cooperation, not genuine collaboration: division of labour (Naismith et al., 2011)	To design a wiki activity in line with actual collaborative learning (Naismith, et al., 2011); to base a wiki activity on negotiation (Bruffee, 1999); to provide an ill-structured problem solving activity (An, 2010); to shift the authority of knowledge to learners (Ruth & Houghton, 2009); to model activity accomplishment with timely feedback (Grant, 2009); to have students get into groups of five (Bruffee, 1999)
Activity assessment focusing on individual performance rather than group process	To use process-oriented assessment (Tharp, 2010)

By understanding the underlying principle of the interventions above, we can focus on the context for collaborative learning. Naismith et al (2011) propose a context for wiki use to support collaborative learning which includes activity design and instruction, assessment procedures, teachers' support as scaffolding, learners' digital literacies with technology (such as wikis), social interaction skills, group dynamics and attending to issues of time and space as they affect the collaborative processes. To understand collaborative processes as social interaction, they note that collaborative activities are time consuming because they need the group working together either in physical or online space. Therefore, a proper balance of both physical and online spaces in the curriculum design should be carefully considered.

Communication among group members is another focus in the wiki curriculum design. Naismith et al (2011) note that ineffective communication among group members could impede collaboration which resulted in insufficient and difficult negotiation among them. The lack of effective communication could stem from several problems, for example, a lack of leadership, clash of ideas or personality, a lack of endurance, excessive information, time management, or unmatched attitudes for collaborative learning. Teacher support should help students' communication to achieve their project goals.

Ineffective communication among group members may result from group size (Naismith, et al., 2011). Bruffee (1999) argued that a group of five would be the optimum group size of students for a collaborative project because it could nurture collaborative processes best by providing effective group dynamic and optimal workload shared by members.

Discussion and conclusion

This paper identifies practical problems in the experience of wiki use, with possible solutions to augmenting collaborative learning for curriculum design. The DBR approach helps teachers to examine "broad-based, complex problems critical to human learning and performance" (Reeves, 2000, p.11). In addition, when the teachers engage in DBR, they can document the implementation of a design, reflect on their research and develop design principles. Through the development of design principles, in the context of this research, the value of teacher and learner interactions in collaborative use of a wiki became evident.

As facilitators and designers of learning, teachers can examine problematic situations and support collaborative learning process, while learners may reflect emerging problems during the project. Hence in this research project the interplay between teacher and learner impacts on the iterative process of design. For example, during the wiki project, an intra- and inter-group commenting activity as part of the peer assessment before and after the midterm examination was implemented, followed by a consultation activity. With engagement in evaluation and reflection, the teacher could identify problems and refine possible interventions for implementation afterwards such as encouraging students to have a leading role among group members to boost effective communication. The preliminary findings indicated that with such interventions students showed learning process and development toward collaborative learning, for instance building a sense of collective community by a joint effort of understanding, being aware of and being able to identify cultural concepts through language use as anticipated in the course learning outcomes.

These preliminary findings do show enhanced collaboration as a result of the activity refinement, suggesting an insight of a crucial teacher role in responding to emerging complex problems with dynamic support critical to collaborative learning. The processing of data is at an early stage, currently exploring the student experiences during the course. The impact of this design on student learning *outcomes* has yet to be analysed. This will be explored through student perceptions of their learning and in particular focuses on the ways in which they understood key concepts of intercultural communication.

In this research DBR provides a critical and applied model for developing collaboration in a wiki learning environment. Importantly, the experience of DBR has supported the teacher as researcher to develop contextual principles that support their engagement with learners, and their application in course design.

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Application of Cytoscape to the Analysis of Diagrams of Mechanisms Underlying Patient Problems

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In problem based learning (PBL) tutorials in a medical context, students solve authentic patient problems with the educational aim to develop their reasoning capacity. A key activity to facilitate development of their reasoning capacity in a tutorial is the construction of diagrams of mechanisms that explain patient problems. These diagrams are networks of discrete elements (such as headache) of patient problems. Analysis of these diagrams may yield insights into students' reasoning styles. To achieve this aim, we employed an application called Cytoscape, which is capable of visualising and analysing networks, to study these diagrams. In this preliminary study, we showed that Cytoscape can be used to analyze these diagrams of mechanisms produced in PBL tutorials. We found that students tend to reason in a hierarchical manner. Parameters are also defined that can be used to identify incorrect and missing links in their reasoning processes.

Key words: Problem based learning, Diagram of Mechanisms, Cytoscape, Medicine, Reasoning and Higher Education

Introduction

The explosion of medical information fuelled by the Internet and the digital revolution is challenging the field of medical education. Medical students and medical practitioners face the challenge of being able to critically appraise, assimilate and apply valid and relevant knowledge to solve patient problems. Problem based learning (PBL) is an important educational approach and philosophy aimed at developing these capacities.

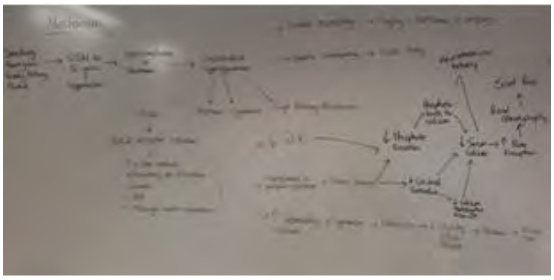
A core educational objective of PBL is to empower students with the skills of basic clinical reasoning, cooperative learning and integration of knowledge of various perspectives of patient problems (Barrows & Tamblyn, 1980; Norman & Schmidt, 1992). In PBL sessions, students construct diagrams of mechanisms to holistically reflect the causes of and pathophysiological processes underlying patient clinical signs and symptoms, incorporating relevant psychosocial issues (Guerrero, 2001) and knowledge from different disciplines, such as anatomy, physiology and pathology. Developing these diagrams is a challenging task as this requires competent critical reasoning skills (Croskerry, 2009). The student-constructed diagrams, especially during initial weeks of entering medical schools, are most likely simple, incomplete and even incorrect in certain situations. Analysis of these diagrams should provide insights into the processes of clinical reasoning and how they can be captured in the diagrams, and may also yield information for guiding students to develop reasoning skills through constructing these diagrams.

The diagrams of mechanisms consist of discrete elements, such as pathophysiological processes (e.g. dehydration) and symptoms (e.g. headache), linked as a network (Figure 1). Analysis of these diagrams using software for visualizing networks could help in extracting useful information that might be otherwise hidden in the diagrams. Cytoscape is an open-source network visualization and analysis software (Smoot, Ono, Ruscheinski, Wang, & Ideker, 2011) and is well maintained by educational and industry organizations including Agilent Technologies. Our own experience with this software in a biomedical domain is very positive (Wang, 2011).

In this preliminary study, our aim was to uncover students' reasoning styles by analyzing various attributes of these diagrams of mechanisms with the aid of the Cytoscape.

Summary of work

PBL is implemented in a metropolitan Australia Medical School for both Year 1 and 2 student groups, with 24 groups in total. Each group is composed of 10 - 12 students and they work through one case each week. Each case usually starts off with patient symptoms, followed with history, clinical examination and completed with patient management. Student groups are encouraged to construct diagrams of mechanisms by drawing on a white board, facilitated by tutors. These diagrams were then photographed for analysis using Cytoscape 2.8 (Figure 1). Thus far fifteen of such diagrams have been analyzed and more will be examined as we gather more of these diagrams. Analysis of these diagrams demonstrated that they are similar in terms of the capture of main pathophysiological processes and different in terms of the organization of these processes. Ethics approval for this study was obtained from the UWS Human Research Ethics Committee (approval ID H9989).



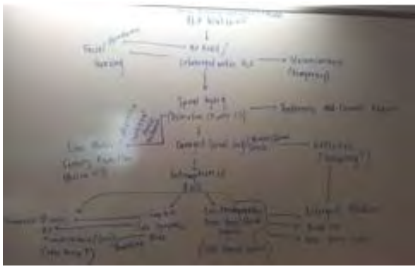


Figure 1: Photographs of original images of diagrams of mechanisms generated by PBL groups for two different PBL cases.

We hypothesize that these diagrams contain information on the patterns of reasoning processes. These patterns are reflected by groups' understanding of problems from various perspectives including psychosocial, biological and pathological perspectives, and at body organizational levels including molecular, cellular, tissue/organ and body systems. While a subjective and holistic appraisal of these diagrams may yield some insights, using Cytoscape enables us to extract and analyze information embedded in these original images in a systematic and efficient manner.

Analysis of the overall patterns of the diagrams of mechanisms

Using Cytoscape, we explored the overall patterns of these diagrams as shown in Figure 2. To fully understand these patterns an explanation of the network is outlined here. Each circle (or node) in the network represents an element which can be a pathophysiological process/concept, patient's symptom, sign or investigation finding. The arrow (or edge) between these circles generally means "leads to" or "results in". The arrangement of these nodes provides clues for reasoning patterns exhibited by students. In this particular PBL case, we found that the overall arrangement of these processes and concepts is a simple structure with the causal processes displayed at the top, and symptoms and signs towards the bottom (Figure 2). This arrangement may represent the cause-effect and progressive nature of patient disease processes, thus supporting the hierarchical organizational mode of knowledge (Novak, 2010) in a patient problem context. The result from this preliminary study suggests that more patterns may be revealed in a subsequent, expanded study of these diagrams.

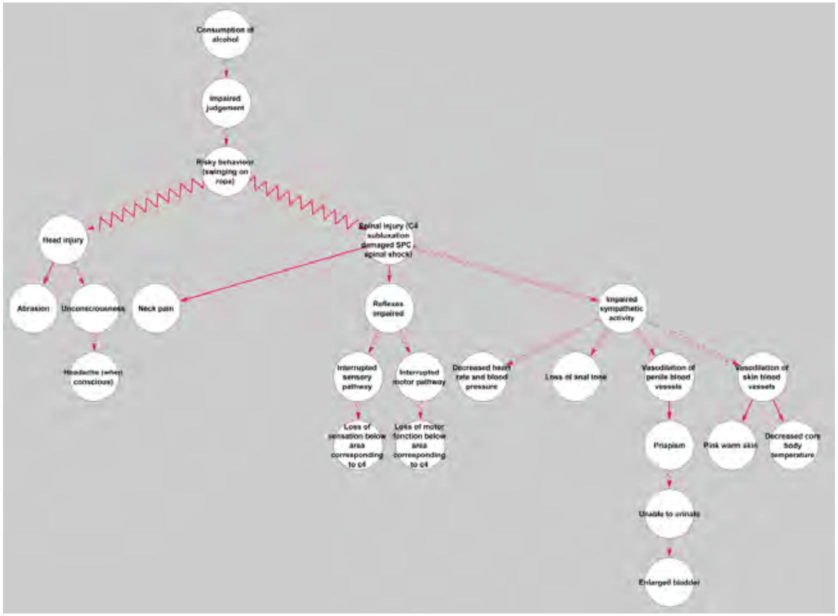


Figure 2: The overall pattern of an example of a diagram of a mechanism visualised using Cytoscape 2.8.

Analysis of particular attributes of diagrams of mechanisms

In addition to the overall patterns, Cytoscape enables us to visualize patient symptoms, organizational levels at which particular processes operate, and organizational level transition steps between causal processes and resultant processes (Figure 3). Analysis of these elements could provide clues to students' reasoning capacities or styles in the context of real patient problems. In Figure 3, the patient symptoms are highlighted as hexagons. It is clear that most of symptoms are terminal nodes, i.e. no child nodes attached to them. This finding suggests that students' reasoning was aimed at explaining patient symptoms. The organizational levels at which particular processes operate are indicated by the sizes of the nodes, the largest ones signify the psychosocial levels such as the "Consumption of alcohol" (single black arrow**).** The smallest circles represent organizational level of tissue/organs such as "Enlarged bladder (double black arrows) while middle sized circles indicate body/system level such as "Impaired sympathetic activity" (single white arrow). This example demonstrates that the students are able to clearly combine psychosocial issues with pathophysiological processes at a system and organ/ tissue level. However, no cellular and molecular processes were considered in this case. This may be the reflection of the nature of this particular patient problem, the high level reasoning processes displayed by the students, lack of knowledge at these levels or combination of these.

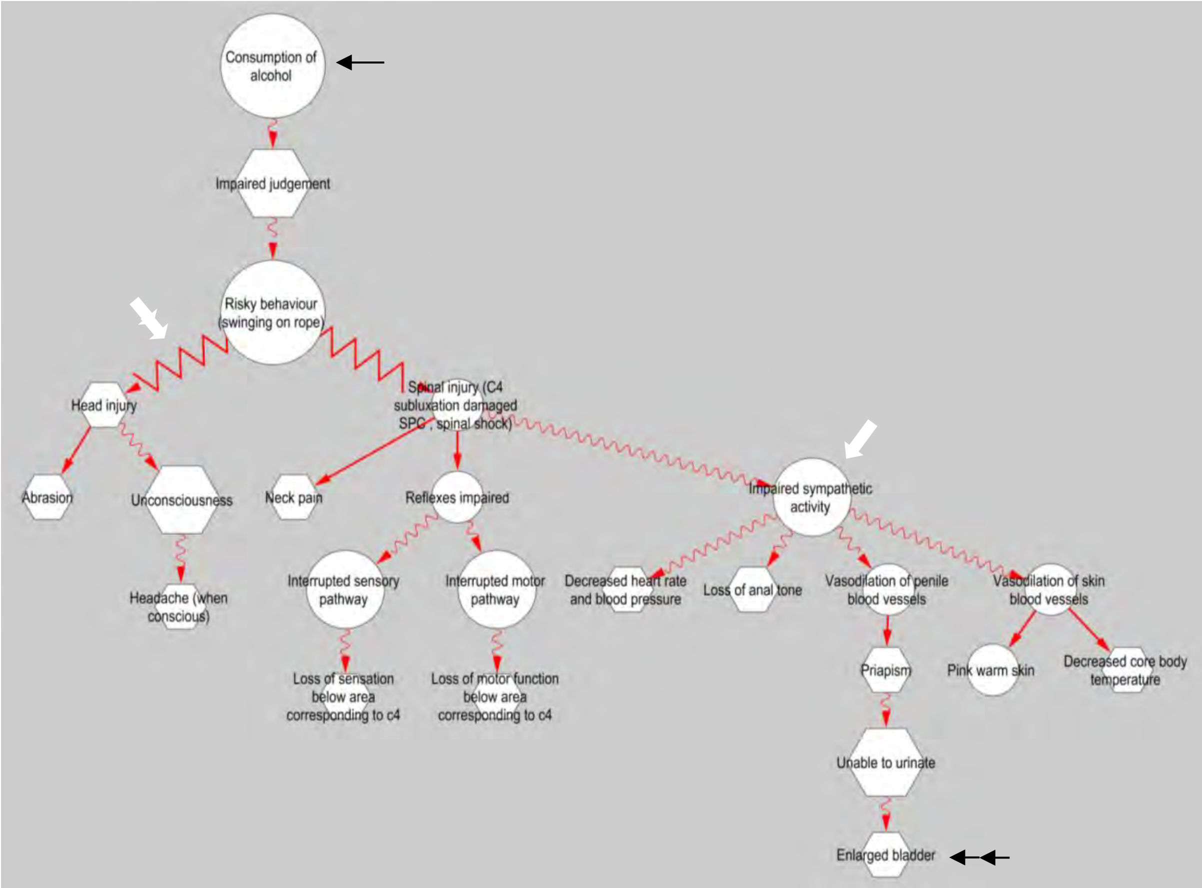


Figure 3: The visualization of the patient symptoms (hexagon), organisational levels (size of the circles) at which particular processes operate, and organisational level transition steps (edge styles) between causal processes and resultant processes using Cytoscape 2.8

In addition to the process and concept (nodes), the linkages between them (edges) can also be used to represent information visually. The zigzag lines (double white arrows) demonstrate that an organization level is skipped from one process to another. For example, from “Risk taking behavior (swinging on rope) - which is at a psychosocial level to the “Head injury” – which is at an organ level, the body/system level was skipped. Adding a middle process of “patient hitting on physical object(s)”, now it reads as “Risk taking behaviours (swinging on rope) → “Patient hitting to physical object(s)” → “Head injury”. The reasoning process is now more complete and logical. This analysis suggests that skipping one or more organization levels as highlighted in the graph can be a useful way to pinpoint possible inappropriate and missing links in students’ reasoning processes. According to Marcum, dual processes occur in the clinical reasoning – a non-analytical and an analytical process integrated with metacognition processes (Marcum, 2012). It is suggested from the analyses that students groups have relied on heavily on the analytical process in the PBL settings, perhaps due to the fact that they lack clinical experiences.

Taking all these results together, it is suggested that two types of integrations occur in PBL mechanisms: i), horizontal integration that combines a psychosocial perspective with a pathophysiological one of patient problems; ii), vertical integration that considers patient problems at all levels of body organization. These findings demonstrate that the PBL educational approach is geared towards the model of biopsychosocial medicine (Novack et al., 2007) and deep learning. The parameters defining these two dimensions of integration are summarized in Table 1. The significance of these parameters is that they can be used for guiding students to construct logical mechanisms, leading to meaningful learning.

Table 1: Parameters useful for analysing the diagrams of mechanisms incorporating psychosocial issues.

Overall pattern	The overall structural patterns of the mechanisms including hierarchical and possibly others.
	Nature of the processes/concept, i.e. causative processes, symptoms, signs and investigation

Particular attributes	findings.
	Body organizational levels represented by the processes/concepts from molecular, cellular to body system levels and psychosocial level.
	Organizational level transition between causal processes and resultant processes.

Conclusion

- This preliminary study shows that Cytoscape can be used to visualize and analyze the diagrams of mechanisms produced in PBL tutorials.
- A hierarchical pattern for organizing different aspects of patent problems is used by students. More patterns may be discovered in a further expanded study. These patterns reflect the thinking styles of PBL groups.
- We defined parameters for looking into these diagrams of mechanisms (Table 1). They can be used for guiding students to develop more meaningful diagrams of mechanisms
- These initial findings warrant future work aimed at further analysis of these diagrams of mechanisms.

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Innovation via a Thin LMS: A middleware alternative to the traditional learning management system.

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This case study describes how a middleware software solution, originally developed to enable course materials to be delivered to tablet devices, eventually replaced an incumbent 'monolithic' LMS at a Business School in the UK. This middleware solution is termed a 'Thin LMS' and consists primarily of software that integrates data and materials from other information systems hosted by the institution.

The advantages and disadvantages of this approach are discussed and it is proposed that the Thin LMS approach offers a viable alternative to the monolithic LMS in certain institutional contexts.

Keywords: E-learning, information systems, LMS, monolithic LMS, thin LMS, VLE, integrator, integration.

Introduction

This case study describes a 2-year process, between March 2011 and March 2013, in which a middleware software solution, a 'Thin LMS', gradually replaced the use of a more traditional 'monolithic LMS' at a Business School in the UK. A 'Thin LMS' is defined here as a learning management system that primarily seeks to integrate external data and software tools. It is defined in contrast to the 'monolithic LMS', which seeks to contain all data and software tools within itself.

This business school, the host institution, forms part of a larger research-based university in the UK. The incumbent monolithic LMS was a commercial system that had been used to deliver online learning at the university over the previous 12 years. In March 2011, a decision was made to provide students on one MSc degree programme with tablet devices in the academic year commencing October 2011. The primary motivation being a programme level learning outcome stating that students should graduate with practical knowledge of contemporary technologies. It was determined that the provision of tablet devices would assist in the achievement of this outcome. The integration of these tablet devices into the delivery of teaching and learning was not a goal at the outset however it was recognised that students would want to use them to access content and communications within the incumbent LMS. Investigation into the compatibility of this LMS with the tablet devices chosen revealed a number of critical issues. The technology adopted to build the LMS was unstable on mobile platforms, a significant proportion of the content within the LMS was inaccessible and the user interface did not translate well from PC to tablet. These issues led to the decision that the use of the incumbent LMS on the tablet devices would result in an unacceptable user experience for the students.

The monolithic nature of the incumbent LMS did not allow the institution to select those tools that were compatible with the tablet devices and discard those that were not. This problem is common to all traditional LMSs and has previously been recognised by Bush and Mott (2009),

> "The education technology landscape is best characterized by monolithic, enterprise technology silos with rigid, often impenetrable walls. Course management systems (CMSs), for example, are generally "all-or-nothing" propositions for institutions, teachers, and students." (Bush and Mott 2009)

This inflexibility in the structure of the incumbent LMS resulted in the system being deemed unsuitable in its entirety and it became necessary to identify an alternative system.

Year one - The 'Hub' version 1

Th Th hscs sdyws md h 'H b' dd v opm hs occ d ually over three years. The initial development, in year one, is now described.

Year one - System specification, build and deployment

Version one of the Hub was developed by the e-learning team at the host institution over the summer of 2011. Development began with a system specification clarifying the functional requirements. These were divided into two categories. First the system was required to deliver content, primarily course materials, and do so in a way that made these materials readily accessible via both PC and tablet devices. Second, the system was required to deliver and facilitate course communications. A key requirement in this latter category was close integration with popular social networks. As elsewhere, students at the host institution were active on social media networks and had expressed frustration at the lack of integration between these networks and the incumbent LMS.

A review of alternative LMSs in May 2011 did not identify a system that demonstrated an acceptable level of compatibility with the chosen tablet devices and the e-learning team investigated the possibility of developing a system in-house. The solution they proposed was to build an online learning environment using the same techniques they were using to build other websites. When building a website this team first selected a content management system (CMS) and then added functionality to this system through the use of compatible 'plug-ins' and by linking to other institutional information systems through the use of application programming interfaces, 'APIs'. The management team approved this approach and development began.

The build started with the selection of a CMS. In order to enable the functional requirements stated above, the primary requirements for the CMS related to communications. For example, the CMS needed to facilitate discussions, integrate with social media platforms and include a tablet application to enable teaching staff to post content to students. This led to four online 'blogging' tools being considered; Blogger, Tumblr, WordPress and Posterous. The latter of these was chosen due to the usability of its interface, the ease at which social media could be integrated and the simplicity of its supporting tablet application.

Following the selection of a CMS, the subsequent challenge was to identify a tool, compatible with the CMS, that would enable teaching staff to share course files via a process that was acceptable to them. Almost all course materials within the incumbent LMS took the form of files such as lecture slides, tutorial documents, case studies and readings. A cloud based documentation system was identified as the solution and two such systems were considered, 'Box.com' and 'Dropbox'. At the time, only the latter had the required level of compatibility with the chosen tablet devices and this was the system selected.

Thus, Posterous and Dropbox were chosen as the primary technology tools. A more detailed specification then followed which took the form of 'wireframe' prototypes of individual webpages. In response to student requests, a communication feed, similar to those adopted in common social media platforms, took prominence within the interface. Content was arranged in accordance with the organisational structure at the institution in which 'faculty', supported by 'programme teams', deliver degree 'programmes' consisting of 'core courses' and 'elective courses' which are assessed via 'coursework' together with 'exams' and are delivered over 'academic years' comprising 'terms'. The adoption of these structures enabled a more cohesive user experience than that possible within the incumbent LMS, which contained just one level of hierarchy, the 'course', and presents these courses in a linear alphabetical list.

The resulting system was termed 'The Hub' and was designed, developed and deployed in four months by one member of technical staff within the institution's e-learning team. At this stage the 'Hub' was not viewed as an alternative LMS but solely as a vehicle to solve the problem of delivering course materials and course communications to tablet devices. Some common course related administrative tools, such as quizzes and assignment submission, remained within the LMS. In addition, course areas were replicated within the incumbent LMS on the assumption that students would use these areas when using a personal computer.

Year one - Results

Providing two versions of each online course area, one in the Hub and one in the incumbent LMS, enabled students to draw comparisons between them. A survey of students (n=67, response rate = 97%) found 'the Hub' to be the preferred system. Students were asked to rate five different characteristics of the two systems from between 0 (very poor) and 5 (very good). Table 1 shows mean scores for the two systems.

Table 2: Comparative evaluation scores between the two systems

	The Hub v1	Incumbent LMS
Overall	4.55	3.42
Look and feel	4.32	2.92
Navigation	4.27	3.02
Usefulness	4.51	3.86
Ease of use	4.51	3.23

The Hub was rated more highly in each category and, for overall experience, the Hub was rated 4.55 out of 5 compared to 3.42 for the incumbent LMS. This survey also found that 97% of students preferred to download materials from 'the Hub' rather than the incumbent LMS. Qualitative feedback relating to the Hub received from both students and staff members was almost all positive. The following examples, taken from a focus group discussion, illustrate the general response.

> *`It is easy to access the hub and we can quickly access news and important information… and download course material (student 32).*
>
> *`The Hub (was) very easy to use... In fact, I preferred it over (The incumbent LMS) as the same information was available in a much more easy-to-use format in one place, rather than having to go through the ordeal of (The incumbent LMS') options and pages' (student 7).*
>
> *`Essentially [the Hub] was very useful for broadcasting to students, we were able to alert students to*

changes, clarify issues ... to me it was like a distribution list, I could respond back to everybody and say, this is what you are doing' (lecturer 3).

`I think [the Hub] is an absolutely fantastic idea because it provides a central platform of coordinating everything ... The fact that you have a central point of contact through which you can run important announcements that might not only impact your class but other classes. And you can actually see what the other people are doing. That I found extremely useful' (lecturer 6).

The project also gained the support of the student union who stated,

"This innovation will greatly improve the student experience for teaching. The use of interactive tablets not only aids understanding, but also provides an alternative learning environment. The interactive nature of the courses opens the doors for all types of learners. The more enjoyable the learning experience, the more appealing to students the course is."

Year one - Summary

Version one of the Hub solved the problem of how to provide course materials and communications to mobile devices. In addition, a number of unexpected benefits emerged. First, the system was considered by teaching staff and students to be an alternative and preferred system to the incumbent LMS. Second, both staff and students embraced the concept of a social media approach to communications and the sense of community this created. This approach replaced the majority of communication channels previously used by teaching staff, students and the administration team. Third, having an increased level of control over the system enabled the e-learning team to create a user interface that matched the organizational structure of the institution and this lead to increased clarity and a greater sense of community as areas of the Hub were created to reflect the social groups in existence at the institution.

Year two - The Hub version 2

The response of students and staff to the combination the Hub and tablet devices had been sufficiently positive in year one for the project to be continued for students starting October 2012. The teams administering degree programmes at the host institution were given the option of using either the incumbent LMS or the Hub on their programmes and these teams chose the latter for 10 of the 14 programmes. As a result, the majority of students at the institution would be using the Hub as the primary web based system for their studies in the academic year 2012 to 2013.

The success of the project in year one together with a resulting higher profile within the institution led to the broader engagement of school staff and the formulation of enabling structures such as a project management team and more formal project documentation. To illustrate, a working group was established to oversee the project comprising representatives from the teaching staff, the administration teams and the e-learning team. Student engagement also increased and the Hub became a standing item at all Staff Student Committee (SSC) meetings. As a result of this activity, four additional goals were set for the project in the academic year 2012 to 2013.

1. To enable the School to move to a paperless programme delivery
2. To make a positive contribution to the students' perception of the School and its programmes
3. To conduct pilot projects in the use of iPads to change learning practice
4. To conduct pilot projects in the use of iPads to change teaching practice

The ambition to move to a paperless delivery comprised a number of dimensions including a desire to move to a more 'seamless' learning environment defined by Chan et al. (2006: 6) as follows:

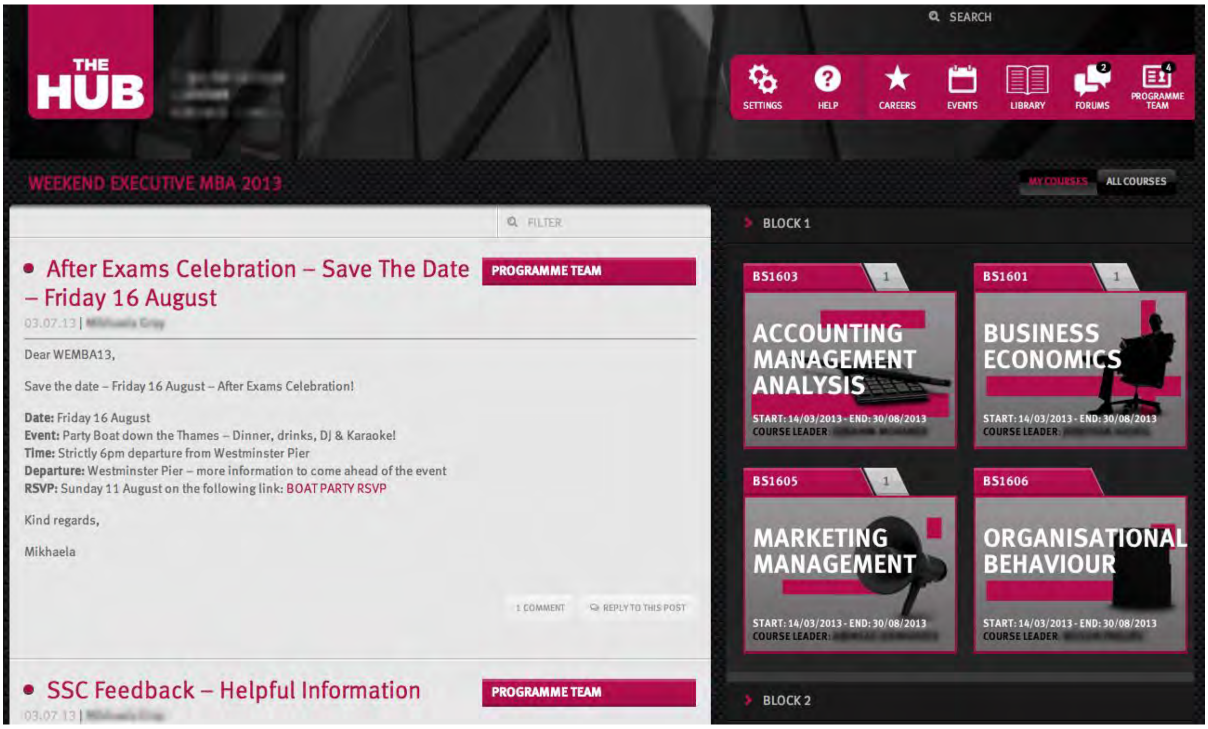
"We see ubiquitous access to mobile, connected, personal, handhelds creating the potential for a new phase in the evolution of technology-enhanced learning, marked by a continuity of the learning experience across different environments. We term this 'seamless learning'." (Chan et al. 2006 p.6)

The portability of the tablet devices together with the ability to access the Hub through any device was considered to be a tool to facilitate such a seamless environment and promote an increased sense of 'connectedness' to the institution. In year one the students had used the incumbent LMS to submit assignments and conduct quizzes but, as this LMS was incompatible with tablet devices, this approach was incompatible with the concept of a seamless learning environment. Enabling this functionality in the Hub became a requirement for year two.

Year two - System specification and build

In year two the structure of the design remained essentially as per year one. The information feed retained prominence within the interface. Content was organised around each student's learning path and the information architecture mirrored the organizational structure of the school. However, several changes were made in response to year one feedback and to incorporate the additional functionality. The latter were primarily minor improvements to functionality such as a notification feature to indicate when content had been changed and the ability for students to view all courses on a degree programme rather than just those on which they had been registered.

Figure 19: The Home screen of the Hub featuring the communication feed



A significant step was to engage the services of an external design firm who were given the freedom to create a 'look and feel' for the Hub that reflected the brand and values of the institution. It was also at this stage that the concept of an integrative platform, the 'Thin LMS' emerged.

The integrative platform

The use of the incumbent LMS required course information and content to be copied manually from other information systems at the institution and in year one this approach was adopted for the Hub. As part of their feedback on the project, administrative staff asked if it was possible to reduce the volume of such work through integration with other information systems. Working closely with the central IT services department, the e-learning team explored this possibility and the idea of the Thin LMS emerged. A core design principle was adopted in which the Hub would comprise middleware that incorporated feeds from other systems through the use of RSS/XML based information feeds and APIs. In year two, information was integrated into the Hub from the following systems:

Table 3: List of integrated services in year two

System	Information obtained	Connection
Student record system	Course information: Title, description, timetable and syllabus. Student information: Photograph, e-mail address.	CSV/XML
Social media (Facebook/Twitter)	Communications made through the Hub appear in social media platforms and visa versa.	WordPress plug-in
E-mail server	Communications can be sent to the Hub by e-mail. Notifications can be sent to e-mail from the Hub.	AJAX
Cloud based file server (Dropbox)	Files are placed within the cloud-based server. An interface to this server appears within the Hub.	API
Library information system	The library system supplies an electronic version of a course-reading list with hyperlinks to the resources listed.	RSS/XML
Lecture capture system (Panopto)	The lecture capture system records all classes. A feed from this system then presents the recordings to students via the Hub.	RSS/XML

In this manner almost all content within the Hub took the form of data feeds from existing systems and the degree of manual work reduced substantially. That which remained consisted primarily of uploading digital materials such as interactive courseware and computer based assessments.

Choice of technology

In year one the Hub system was non-critical in that all course areas were duplicated within the incumbent LMS and students were informed that the project was at a pilot stage. In year two neither of these factors were present and thus closer attention was paid to the robustness of the system and the following measures were taken to address this. Responsibility for the development of the system moved from the single in-house technical developer to an external software firm thus removing a potential single point of failure. Conversely, the hosting of the system was moved onto internal web servers so that matters of data protection and security could be addressed. In order to ensure that the system would be sufficiently scalable and reliable, version one of the Hub was discarded and the system was rebuilt.

As per version one, a blogging platform was chosen as being the most appropriate tool to facilitate communication. The firm providing the tool used in version one, ‘Posterous’, had been purchased and closed during the previous 12 months and was no longer an option. An alternative system ‘Wordpress’ was chosen as it met the criteria required, offered the simplest integration with college systems and was structured via a ‘plug-in’ system. This latter characteristic enabled the Hub specific code to sit in a separate ‘plug-in’ which would not need to be changed should the core code do so.

As discussed above, the Hub connects to a number of institutional information systems via XML/RSS feeds or APIs. The former feeds are encrypted and placed on the web server hosting the Hub. A Wordpress plug-in, the ‘Hub Feed Manager’, then retrieves the information and outputs to the Hub in the appropriate place. The seamless learning approach was implemented using ‘responsive design’ in which a webpage first detects the screen on which it will be rendered and then adapts itself to an appropriate format. Assignments were implemented using Dropbox via an API called ‘Jotform’. Quizzes were implemented via an online tool called ‘ProProfs’. However, the use of these technologies were considered to high risk and were therefore piloted on just one programme in year two. For the remaining nine programmes, the quiz and assignment functions were performed in the incumbent LMS.

Year two - Results

In October 2012, 671 students and 84 teaching and administration staff started to use version two of the Hub. As on June 2013 this version of the Hub has received 342,791 individual visits and 1.8 million page views meaning that, on average, staff and students logged on to the Hub 1.66 times per day over the initial nine months. While, a full evaluation of the Hub is still in progress, an initial survey of students was conducted in in January 2013 (n=147, response rate - 22%). As in the evaluation in year one, this survey first asked students to rate a number of characteristics of the system. The responses are summarised in table 3 below.

Table 4: Summary of responses to survey conducted in January 2013

	The Hub v2
Overall	4.25
Look and feel	4.22
Navigation	3.78
Usefulness	4.43
Ease of use	3.99

The survey also attempted to gather data relating to the aims of the seamless learning environment. Students were asked whether their use the Hub had made them feel more connected to their programme when away from the school as compared to previous degree experiences. The responses to this question are summarised in table four.

Table 4: Sense of connectedness

	Number of responses
I feel much more connected	39.86%
I feel more connected	46.62%
There is no difference	11.49%
I feel less connected	1.35%
I feel much less connected	0.68%

Qualitative data was also gathered by posing the open question, “What has been your overall experience of using The Hub for your studies?” The positive responses to the survey tended to focus on usability. For example,

> *“I really like the hub. It's very convenient to access all the formation about the courses at any time. It's very well-structured making it easy to look for things.”(Student 1)*

> *“I have found it relatively easy to find documents and navigate which is the key criteria I judge it on.” (Student 2)*

> *“What I love about the Hub is that it is very structured, you can find all the information in the relevant places and it is very helpful to save time.” (Student 3)*

Negative responses also tended to focus on the usability of the Hub from which the conclusion can be reached that this is an issue of primary concern to the students.

> *“I love the Hub but the navigation is not easy from my Mac laptop, the website does not appear clearly” (Student 5)*

> *“(The Hub) Need(s) to be more user-friendly” (Student 6)*

An analysis of system usage suggests the use of the Hub led to an increased level of student activity with the online learning environment. The use of the Hub in year two was compared to the use of the incumbent LMS in the previous academic year. Using a sample of three degree programmes revealed the number of visits by students to be 61% higher when only the Hub was used compared to when only the incumbent LMS was used. This is shown in table 5.

Table 5: Number of visits to 16 courses on Incumbent LMS and the Hub

System	Number of visits
The Hub Oct 2012 - June 13	43,302
Incumbent LMS Oct 2011 - June 2012	26,860

Students' use of electronic resources, such as eBooks and journal articles, also increased as a result of the integration between the Hub and the library's online system. The library reported a 700% increase in the number of visits to such resources.

The level of activity among teaching staff also increased. For example, table 6 shows a comparison of the number of teaching materials placed into each environment, again using a sample of 3 degree programmes.

Table 6: Number of course materials placed in the learning environment

System	MSc 1	MSc 2	MSc 3	Total
The Hub Oct 2012 - June 13	77	64	116	257
Incumbent LMS Oct 2011 - June 2012	82	46	61	189

The number of learning materials placed within the learning environment increased by 36%. In addition to uploading more course materials, teaching staff were also more likely to do this themselves rather than requesting that administration staff do this for them. On courses that used the incumbent LMS, 20% of teaching staff chose to upload materials and communications directly into the LMS. However, this percentage increased to 72% on courses supported by the Hub. Staff on105 of the 149 courses comprising the 10 degree programmes choose to load materials and communications directly into the system.

Year two - Summary

The evaluation of version two is on-going however the initial survey of students together with an analysis of system usage suggests that the benefits observed in year one were present for the additional nine programmes that used the Hub in year two.

In addition, noticeable increases were observed in the volume of student and staff engagement with the online learning environment when the Hub was used. This increase in engagement was accompanied by a substantial reduction in time spent on course administration due to improved systems integration. The initial survey also suggests some success in achieving a seamless learning environment in that students reported a stronger sense of connectedness to the institution as a result of using the Hub.

Year 3 - The Hub version 3

As of June 2013, the administration teams for all degree programmes at the School have decided to adopt the Hub form October 2013. The assignment submission and quiz tools piloted during the implementation of version two proved sufficiently robust and these functions will be conducted via the Hub and not the incumbent LMS, albeit using different technology tools. Given this, the Hub will have replaced the incumbent monolithic LMS from October 2013. Further developments are also planned included the addition of learning analytics to provide students and teaching staff with greater visibility on usage and comparative performance.

Discussion

This case study detailed the development of a ‘Thin LMS’ and explained how this system replaced an incumbent ‘monolithic LMS’ over a two year period. The host institution in this case study experienced a number of advantages and disadvantages in adopting this approach and these are now discussed.

A greater degree of control of the user interface. The incumbent LMS appeared designed to be usable across numerous institutions however this ‘one size fits all’ can mean that the one size does not fit at all. In this case study the ability to structure a learning management system so that it corresponds to the organizational structure of the institution, and the ability to create a ‘look and feel’ that was consistent with the university brand and imagery, resulted in an improved user experience which was valued by staff and students.

A closer integration with institutional information systems. The greater degree of control inherent in the Thin LMS approach allowed a closer integration of the learning management system with other information systems. This led to increased accuracy and volume of data and communications within the LMS while significantly reducing the work required to administer the system.

The adoption of ‘best-in-class’ tools. The Thin LMS approach enabled the institution to choose the best tools available and not just those that were packaged within the LMS. As Bush and Mott (2009) suggest, this is not possible with the traditional monolithic LMS

> “.. Even if you use an open source CMS like Moodle, you are (without significant customization) bound to use Moodle’s content publishing tool, Moodle’s quiz tool, Moodle’s gradebook, ..."
> (Bush and Mott 2009)

That the e-learning team were able to adopt tools, such as DropBox and Facebook, that were already widely used by staff and students is likely to be one cause of the noticeable increases in engagement observed.

An increase in innovation: In this case study the Thin LMS facilitated a greater degree of innovation. It could be expected that commercial LMS vendors would be able to innovate to a greater degree that a single institution would be able due to having larger resources at their disposal. However vendors have not been particularly innovative. This may be due to the fundamental design approach of the common monolithic LMS systems which Britain and Liber (2004) suggest focuses only on,

> “establishing a viable functioning system rather than supporting innovation” (Britain and Liber 2004)

In this case study an increase in control over the learning system enabled significant innovative steps. For example the integration of ‘best-in-class’ tools and information from other systems. In addition, the working group formed to oversee the project felt a degree of empowerment not experienced in relation to the incumbent monolithic LMS in that their update requests, and therefore innovations, could be more readily enacted.

A loss of advanced learning features. From a pedagogical perspective, the more advanced learning features, such as the integration of learning pathways with analytics and subsequent assessments, could be considered among the most attractive features of the monolithic LMS and these features are not readily replicated within a Thin LMS. Quizzes too are more problematic for teaching staff in the Thin LMS introduced here as staff now need to forward quizzes to the e-learning team to be uploaded into the system rather than doing this directly. Such issues could be considered to disempower teaching staff or rather to disempower the minority who used such tools while empowering the majority who did not.

Changing roles within central IT services department: In this project, the work required to conduct systems integration was different, and often more complex, that the work required to administer a monolithic LMS. Securing the time of staff with the relevant skills was a initial challenge during the development stage.

Scalability: The host institution in this case study is a Business School forming part of a larger research-based university. A key advantage of the Thin LMS approach was the ability to structure the system to mirror the structure of this School. This advantage may be lost should the system be adopted across the university as the organisational structure of departments varies. Another potential barrier to the scalability of the approach is that the success of the project was likely due in part to the close relationships present between the e-learning team and the teaching staff. The trust formed as a result of these relationships assisted in the adoption of the system. This type of project may be more problematic when conducted across a larger organization in which relationships are more fragmented.

Cost. The relative costs of the Thin LMS adopted in this study compared to the incumbent LMS are yet to be evaluated but are considered to be either cost neutral or lower. One indicator to support this is that the initial development costs of the Thin LMS over the two years were less than the annual licence paid to the vendor for the incumbent LMS.

Summary

This case study has described how a middleware software solution gradually replaced the use of a more traditional 'monolithic LMS' at a UK based institution. This approach was termed the Thin LMS and the advantages and disadvantages were discussed. It is proposed that the Thin LMS approach offers a viable alternative to the monolithic LMS in certain institutional contexts.

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Implementing Timely Interventions to Improve Students' Learning Experience*

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This paper describes the development of an approach aimed at increasing student engagement and outcomes in online business studies. Personalised real-time interventions were used by lecturers to encourage online participation and enhance students' overall experience through engaging them in the online learning environment. This 'high touch' approach was developed using analytics from the learning management system (LMS) to determine key points for interaction and a series of interventions were implemented at these points during the teaching period. These interactions were evaluated through student reactions and surveys to assess students' perceptions of their value in enhancing learning, and the impact on retention and student success.

Keywords: Learning analytics, online learning, student engagement

Introduction

As higher education looks to the future and learning is offered increasingly via online delivery, universities find it increasingly important to develop ways to enhance student learning through applied use of the technologies. Analytics is seen as a means for higher education institutions to increase student retention and success (Bischel, 2012, p. 5) and universities are increasingly employing analytics as part of their business processes.

This paper describes an approach developed to employ learning analytics at the subject level in an interactive approach intended to increase student progress, success, engagement and to tailor learning to improve achievement of student learning outcomes. This project, which was supported by a grant from the Office for Learning and Teaching, commenced with the identification of touch points for students in relation to the subjects they were undertaking. These key points were then assessed for potential impact if an intervention was enacted. Personalised interactions were implemented by the teaching staff which were tailored to the critical point in the teaching period. The project included both undergraduate and postgraduate subjects and all students were studying fully online.

Learning Analytics

The use of learning analytics in higher education is increasing as online education grows. Distance education facilitated through online studies means that students are increasingly diverse in demographic characteristics, and support systems that utilise 'big data' to predict student success, engagement and learning experience are becoming more important for institutions seeking to deliver high quality education for students. Elias (2011) and Shum and Ferguson (2011) suggest that analytics provides the application of business intelligence tools to capture and interpret data in order for academia to individualise and optimize learning. Increasingly, "the use of analytics is becoming more prevalent in educational institutions where learner data and behaviour tracking can inform learning and teaching practice" (Fisher, Valenzuela & Whale, 2012, p. 4). Brooks, Greer and Gutwin (2012, p. 1) identify the goal of learning analytics as a means to "provide insight into learners based upon their activity in e-learning systems". Many learning analytics projects discussed in the literature have shortcomings in terms of the application of real time data to inform learning and teaching practice (Fisher, Valenzuela & Whale, 2012). This project aims to contribute to the literature related to the real-time, lecturer initiated use of analytics to improve student learning outcomes and satisfaction.

Analysis of subjects

This study analysed three subjects (two postgraduate and one undergraduate) offered by the University of New England Business School to determine key points and behaviours to trigger interventions with students that were thought to be likely to increase success, engagement and overall experience. These interventions were specifically targeted at students who were considered to be at risk and were in addition to general reminders sent to all students through the LMS.

The key points and behaviours targeted were:
Intervention 1. First two weeks of Trimester – no access to the LMS and learning materials for over seven days
Intervention 2. Early assessment tasks – reminders prior to due date and poor results or non-completion
Intervention 3. Major assessment tasks –limited or no access to assessment information for over seven days prior to the due date

Although a similar approach was taken in each subject, because each had a different combination of assessment tasks, the interventions and their timing varied across subjects.

For all students exhibiting these behaviours at the key points, personalised interventions were developed and implemented by lecturers with the goal of prompting increased engagement with the subject. The interventions were tailored to the key point and consisted of telephone contact and / or email contact on a one-to-one level with the student. Further contact was invited and maintained if prompted by the student.

Detailed information about the process that was put in place and the results are provided in Table 1.

Table 1: Results of Interventions

Behavior	Intervention	Result
No access to LMS for over seven days during first two weeks of the trimester	*INTERVENTION 1* 43 students were contacted to remind them to set up study plan and check if there were issues The subjects involved were: - MM110 – 17 students contacted - GSB731 – 9 students contacted - GSB751 – 17 students contacted 17 Students were contacted by phone and 26 by email	MM110 – all 17 had multiple access GSB731 – multiple access by 8. One student planned to withdraw GSB751 – multiple access by 15. Two students indicated their plan to withdraw when contacted.
No access to LMS for over seven days before assignment due day of an early non compulsory assessment task	*INTERVENTION 2.A* Personal emails were sent to students to remind them about the first assessment due date and to offer additional support The subject involved was: GSB751 – 18 students contacted	Two students replied thanking the lecturer for getting in contact with them 9 students subsequently attempted the activity

Did not complete or did not receive full marks for the early non compulsory assessment task	*INTERVENTION 2.B* Personal emails were sent to students to offer additional assistance The subject involved was: GSB751 – 17 students contacted	15 of these students went on to successfully complete the subject
No access to LMS for over seven days before assignment due date of a major assessment task	*INTERVENTION 3* Personal emails were sent to 36 students to remind them about the first assessment due date and to offer additional support The subject involved was: MM110 – 36 students contacted	Three students replied thanking the lecturer for the information 25 students subsequently submitted the assessment

From this table it can be seen that a total of 43 students enrolled in the three subjects were recipients of the first intervention (17 by phone and 26 by email). Subsequent to this contact, 40 of these students accessed the LMS multiple times. The second intervention employed in one subject consisted of an email reminder to the 18 students who had not accessed the LMS in the seven days prior to the early non compulsory assessment task. Nine of these students subsequently attempted the task. After the due date students who either did not complete or did not receive full marks for this task were contacted by email offering additional support. Finally, the third intervention consisted of emails sent to 36 students who had not accessed the LMS for more than seven days prior to the due date of the major assessment task. Of these students 25 subsequently submitted the assignment.

In order to determine students' level of satisfaction with the interventions and the impact of the interventions on students' learning experience, an online survey was carried out. Invitations to participate in the survey were sent out to all students who were involved in the interventions as shown in Table 1. A 35% response rate has been obtained so far. Results show that students gave a very high evaluation to the interventions (see Figure 1 below).

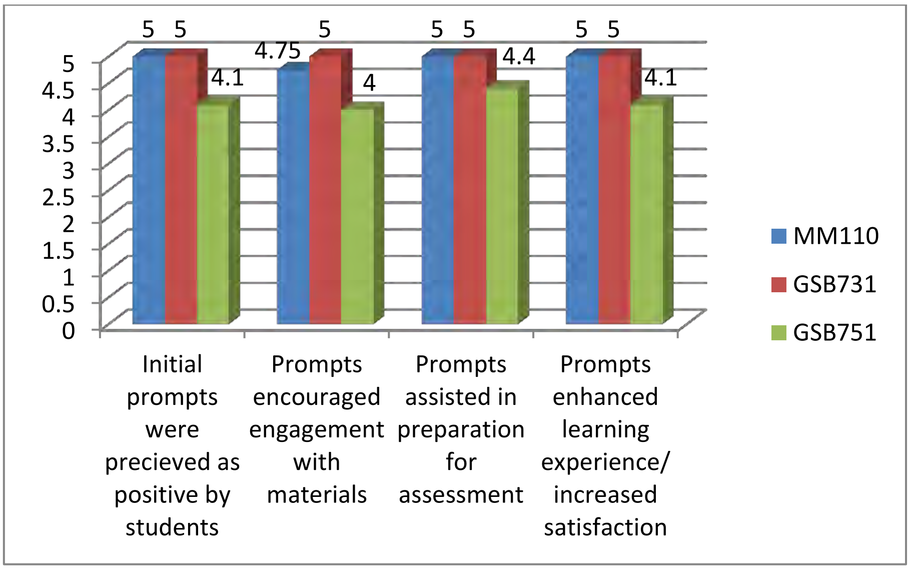

Figure 1: Targeted Students Survey Results (out of 5)

In particular students perceived the initial prompts positively; they indicated that the prompts encouraged them to engage with materials; they considered the prompts assisted them in the preparation of the assessments; and that the prompts enhanced their learning experience. In order to determine if the overall learning experience of the students involved in the interventions were significantly better than of those students who were not involved, an additional set of questions was administered to all students. Fifty seven responses were obtained from students who were not targeted by the interventions and 16 from students who were involved in the interventions. One of the questions asked students to rate their overall online learning experience. Results show a significant difference ($p<0.05$) between these two cohorts of students (i.e., means of 4.0 and 4.3, respectively) in favour of students who were involved in the interventions (see Figure 2).

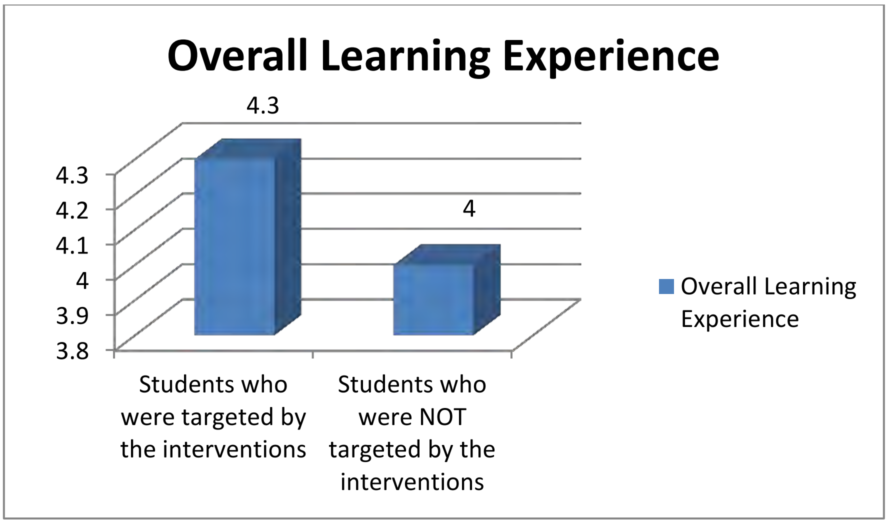

Figure 2: Results of End of Trimester Survey (out of 5)

Conclusions

This project demonstrates a simple approach to the use of learning analytics by teaching staff to improve students' learning experience. Tracking students' activities and the timely implementation of interventions has the potential to influence students' behaviours and improve their chances of success, and hence to enhance students' online learning experience. Identification of likely behaviours which may impact adversely on student results in online learning were determined through a review of the learning materials and timelines for each subject. Consideration was given to the timing and format of interventions. Students were contacted personally, rather than by an automated means. Students' responses revealed that these interventions were highly appreciated as they improved their learning experience. The project will be reviewed and revised and rolled out to a larger number of subjects to provide an opportunity to evaluate of the impact on students' online experiences and outcomes across a broader sample.

One of the challenges that became obvious during this project is the question of workload. The teaching staff involved spent significantly more time supporting students than in previous offerings of the subjects. If it can be demonstrated that the project has been successful and a larger project confirms this finding, then institutions have a good reason to provide support to teaching staff to engage in this level of interaction with students.

*Support for this project has been provided by the Australian Government Office for Learning and Teaching. The views in this project do not necessarily reflect the views of the Australian Government Office for Learning and Teaching.

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Lecture Capture: Student Hopes, Instructor Fears

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Technology to capture and retransmit lectures has been widely available for more than two decades. However, the widespread expectation that universities will record all lectures is not matched by systematic research and theory on lecture capture use. This paper provides a brief overview of research and reports a three-phase study of lecture video use and perceptions carried out with the staff and students of an undergraduate psychology program at a large suburban university. We found that some lecturers are concerned that mandatory lecture capture creates copyright problems and reduces their ability to provide their best teaching. There is also evidence that lecture capture decreases attendance and lowers grades for some students. However, our results indicate that for students enrolled in face-to-face units, the availability of captured lecture videos offers a valuable revision tool which is integrated into "traditional" study patterns rather than replacing them.

Keywords: lecture video; lecture capture; mixed-methods.

Background

Lecture capture (LC) technology - hardware and software which can record live lectures for retransmission in multiple (usually digital) formats - has been widely available for several decades. The most widespread application is probably capturing face-to-face lectures to supplement students' lecture experience or provide flexible study options for students who are not be able to regularly attend classes. Such recordings may also be "recycled", or more polished studio-made recordings produced, to completely replace live lectures. In some cases this may be a cost-saving measure, or a means of accommodating staff absences. In completely online courses video is the only feasible method of delivering something approximating a traditional lecture. Some completely online course deliveries (e.g., Coursera http://www.coursera.org) make use of multiple short videos (typically only 10 minutes long each) to provide students with an introduction to content that would traditionally be covered in a lecture or assigned reading. Other online offerings, such as Swinburne University of Technology's (2013) psychology units offered through Open Universities Australia, use video overviews or "bookends" to outline the structure and introduce key topics to be covered in the readings and learning activities. We can also imagine blended designs where the videos may be intended as preparatory material, and the hours of face-to-face teaching they would have occupied are replaced by other non-lecture teaching activities such as laboratories, tutorials, and workshops.

It is important to recognise that we cannot make blanket statements about "lecture videos" – for example short podcast and full length lecture captures are perceived and used very different by students and recommendation regarding one do not generally apply to the other. For example in a study by van Zanten, Somogyi, and Curro (2012) found that while students value full length lectures as much as short podcast they made much more use of short (~5 minute) podcasts. In this paper we discuss videos captured from live lecture offered in addition to face-to-face lectures or as a substitute for missed lectures. This is a specific pattern of use which is both widespread, and is likely to be a point of increasing focus in the near future as higher education institutions respond market demands for learning resources or transition to blended teaching methods which do not involve large group lectures. Unless otherwise stated, this somewhat narrow definition is what we mean when we use the term lecture capture or lecture video. Most technologies come at some cost, the full extent of which is not always recognized (Laurillard, 2007a) and frequently not thought about how they work (Laurillard, 2007b). Aside from financial considerations lecturers express concerns that LC is eroding the quality and freedom of their teaching and attribute lower attendance rates to it. The trend of offering students LC as an additional learning supplement opportunities is part of a bigger international trend towards increased technological initiatives (see, for example, Concannon, Flynn, & Campbell, 2005) the effects of which on educational outcomes are yet to be fully realised.

In Australia LC for on-campus units is fast becoming a de facto standard and is expected by most students. While major universities have often recognised that LC should or has available at instructor's discretion used with due consideration of pedagogical and copyright issues (University of Melbourne, 2013), some student unions have petitioned for LC policies mandating the recording of all lectures (e.g., La Trobe Student Union, n.d.) and won them (La Trobe University, 2012; University of Melbourne Student Union, 2013).

With increased demand for flexible learning programs there is pressure to put lecture content online, but should we do so just because we can? It is clear that for students studying in distance modes, LC or purpose-made videos are the only real alternatives to face to face lectures, but it remains an open question that many instructors are asking as to whether offering LC as an option for face-to-face students or entirely replacing lectures with recordings is a good idea. Over four decades ago, in his discussion on the use of broadcast video for supplanting live lectures McConnell (1968) remarked on the lack of principled evaluation of the effectiveness of teaching techniques and technologies. What has changed in nearly half century? Putting the terms "lecture," "video", and "podcast" into EBSCOHost searching title, keywords, abstract and subject returned more than 7,000 hits at time of writing. Narrowing these to peer reviewed publications reduces this to about 2,500 and adding the subject area "higher education" reduces this to 202. Other filters can be applied that reduce or increase this number, but this is a sufficient sample to make a few points. By most standards this is not an inconsiderable amount of research, nor is it large. Limitations of this search are considered in the discussion.

What is the substantive content of this body of work? It is beyond the scope of this paper to do a thorough review, but we can paint a picture of what researchers have done. We attempted to summarise the themes of these papers and ended up developing 6 distinct and 3 somewhat overlapping categories which captured the main themes of the papers (categories are italicised in the remainder of this paragraph). Just over 30% were *irrelevant* – they contained the search terms, but were not actually about lecture videos (e.g., the paper was about using TV and film clips in lectures). About 5% concerned live *teleconferencing* (video technology used in live lectures). About 20% were *theory and review* papers or described the *development of courseware* (which included lecture/video content), and just under 15% described the *development of technologies* related to lecture videos (e.g., software to time index lecture videos and share these tags on LMSs and social media sites; automatically generating lecture summaries by offline processing of lecture recordings; editing tools). About 1% did not neatly fit any of these categories ("*other*"). Of all the papers found only thirty-point-seven per cent (60 papers) dealt specifically with lecture videos created from or designed to replace live face-to-face lectures. About one third of these dealt solely with student or staff *perceptions of lecture videos or their attitudes* towards them (e.g., liking, reported effects on study habits), with some mentioning motivation and effects on attendance. Just over a third of these dealt primarily with evaluating the *instructional effectiveness* of LC (e.g., the learning outcomes associated with LC alone or in combination with or contrasted against other study opportunities as gauged by quizzes and exams). A little over a third of these papers dealt with both *motivational/attitudinal aspects and instructional effectiveness of LC* in equal measure.

Studies that have measured outcomes with final exams or used quantitative learning measure such as quizzes, provide mixed evidence about the help or harm done by LC. Some have found courses with LC embedded in or as the sole form of instruction lead to better student outcomes (Houts & Taylor, 2008) while other researchers have found face-to-face instruction outperforms online methods even when significant resources are devoted to the online version (Slater & Jones, 2004). Although there are both negative and positive findings the modal finding is that, at the very least, providing LC does not impede student performance (e.g., Crain, 1994; Hudson & Holland, 1992), or the difference arises from the *way* in which students use it (de Boer, Kommers, & de Brock, 2011). Many of the papers we classified as primarily addressing *instructional effectiveness* which found that lecture videos could improve learning did not effectively control for motivational and sampling issues, for example performance gains occurred within experimental groups that had nearly total video-watching compliance or naturalistic studies do not capture the losses associated with disengaged students who failed to watch the videos.

Recent large-samples studies (e.g., von Konsky, Ivins, & Gribble, 2009) have failed to find any strong association between LC and lecture (non-attendance), but do find LC is used for missed lectures and it is not entirely clear what role the availability of LC has in deciding to skip a lecture, even it is made up later. Despite the lack of association between LC and lecture absence, those who do not miss lectures and those that use LC in addition to lectures tend to gain higher grades. When LC is deployed in a course, there will be a complex interplay between the pedagogical and cognitive factors on the one hand (of themselves are videos capable of fostering good learning outcomes) and affective and motivational factors on the other (e.g., whether people want to use the technology, and whether its availability leads to helpful or unhelpful outcomes, e.g., skipping lectures). Experimental, qualitative, and survey research are required in combination to create optimal learning designs, and the remainder of this paper reports on a three-phase study which attempts to utilize multiple methods in understanding the needs and behaviours of our students.

Method

The setting for this study is a large Victorian university with both inner and outer suburban campuses running a 3-year APAC-accredited undergraduate psychology major. At time of writing the university had LC capabilities in many (but not all) of its medium and large teaching spaces, using *lectopia* to schedule, capture, and mange recordings for units, using blackboard 9 as their LMS. There was no official policy mandating LC use, but student feedback on teaching has regularly indicated that students expect it to be available. The recording is opt-in and must be booked by lecturers, but all undergraduate psychology lectures are taped unless there is a reason not to (e.g., guest speaker, copyright limitations). All lectures in the psychology major are offered twice: once during work hours and once out-of-hours (i.e., after 5:30pm) to provide flexible learning opportunities for students with work and personal commitments.

The study comprised three phases which each focussed on different sources of information. Ethical approval to conduct the research was obtained from the university's human research ethics committee and faculty approval was obtained to approach staff and students for this research.

Phase 1 – Lecture Video Usage Data

The conveners of units were approached before the second semester of 2011, and were asked if they would be willing to have information collected from their units regarding lecture video usage. Conveners from core units at each undergraduate year agreed, and first year introductory psychology, second year cognitive psychology, and third-year social psychology were selected as the foci of this study. The conveners regularly used LC technology by using a central booking service which remotely schedules recordings and automatically makes them available as a Blackboard resource. Conveners were already familiar with how to deploy recording links and podcast feeds on their Blackboard sites, but were given additional instruction on configuring the Blackboard environment to track LC video access. "Click data" - which records the date and time of each unique access of a lecture recording – was tracked over the semester and downloaded at the end of the exam period. It is important to note that a click does not guarantee that the video was viewed in whole or in part, simply that an attempt to access it was successful.

Phase 2 – Focus Groups

Although Phase 1 provided objective information about student accessing of lecture recordings, it was recognised that richer qualitative information regarding student and staff perceptions of LC usage was required. To this end five open-ended focus groups were held, three with students and two with staff. All focus groups were conducted by the same person, an experienced qualitative researcher who asked staff and students to comment on issues related to the use of lecture video software. Groups had a maximum size of 8 persons and typically took an hour.

Phase 3 – Student Survey

The qualitative results of Phase 3 were used to develop a short survey to validate some of the observations from the focus group and obtain a representative sample of students across all year levels to address a few specific LC-related questions, specifically: 1) what are the reasons students access lecture recordings, 2) are there differences in LC use/perception across different year levels, 3) reasons that student do *not* access lecture recordings, and 4) information regarding what faculty might do to increase LC use.

Participants
Fifty-seven students completed the survey. Participants ranged from 18-54 years of age. Fifteen were male (26.3%), the remaining 40 were female (70.2%), two did not give their gender. This age and gender profile is consistent with the enrolment of the undergraduate psychology major.

Materials and Procedure
The survey consisted of 15 multiple option/numeric answer questions assessing demography (gender, age, year level, average grades) and use and perceptions of LC technology (how often and how much LC is used, how useful it is, role in lecture attendance, barriers to use). There were also three open-ended questions asking students to identify the best thing about the technology, what would make it more useful, and a wish list of software features. The survey was delivered using *Opinio* (2013) online survey tool. Students in the selected undergraduate units plus a fourth year/honours psychology unit were invited to participate via announcements placed on the LMS in the final week of classes. Informed consent was obtained, consent indicated by completion of the survey.

Results

Phase 1 – Lecture Video Usage Data
The lecture recording system used (lectopia) has a number recording options. These include: audio only; audio and data projector; audio and lectern (video of the speaker); and audio, lectern, and data projector ("dual capture"). The lectern option is not available in all spaces. The LC system automatically produces all "lowered order" versions of a capture, and at multiple resolutions (different file sizes for download) e.g., if the dual capture option is selected, the audio only, audio+data capture, and audio+video versions are produced as well.

All the teaching staff in the surveyed units used the audio+data capture version, which is the system default. Anecdotally this is the format used by all lecturers in the psychology group. Some remarks regarding this are given in the section of these results describing Phase 2. Each lecture is delivered twice. Only the repeat delivery is recorded, which is available within an hour of the end of the lecture.

The hit data for each unit are presented in plots showing the total number of accesses for each recording across the whole teaching period, the number of accesses for each calendar week of the teaching period aggregated across all recordings (note, students cannot access future recordings!), and the time of day for accesses aggregated across lecture recording and teaching period. Between them these displays give an indication of what topics/lectures students are watching, when in the semester they access them, and how these accesses are timetabled into students' daily lives. Plots and descriptions of the data are given separately for each year level. There were 12 lectures for each unit, the whole teaching period covering 13 weeks with a non-instruction period in the seventh week. The exam and revision period occupies weeks 14 to 16 in these plots.

Lecture Topics Viewed
Figure 1 displays the lecture topic (i.e., lecture delivered in each week of semester). For first years, the first lecture was the most viewed, with almost as many hits as enrolments. Accesses quickly tapered off and trended down to an average of 243, with a bump interrupting the trend in week 6 lecture.
Second years showed a similar, but less pronounced version of this pattern. Owing to a technical glitch the first lecture failed to record. Thirty-one students tried to access it before the link was removed. This underscores the point that hits do not equate to views. After an initial peak in number of views for lectures early in the sequence accesses tapered off to an average of about 99 per week with slight increases in accesses of the week 7 and 11 recordings.

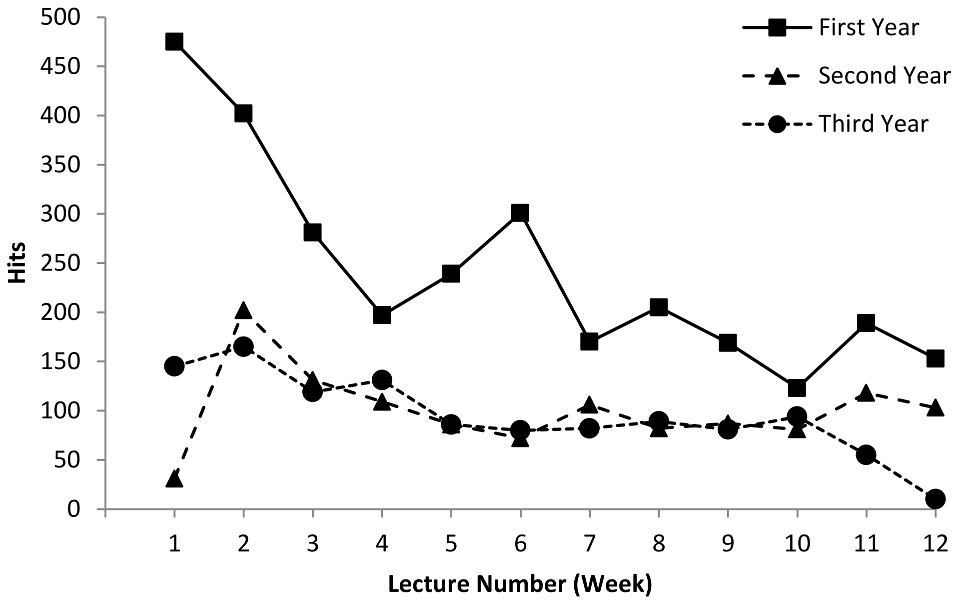

Figure 1: LC download hits per lecture for 1st, 2nd, and 3rd year students. Note that a non-instruction week (not shown) is interposed between lectures 6 and 7.

While there are small differences in some areas, third years showed striking similarities to the first year data. As with first year, the most accessed lectures were the first two, with a small surge in accessed for the lecture that preceded the study break. As with the other two year levels, there was a major trend for accesses by third years to decline for later lectures but a small amount of oscillation around the main trend.

Lecture Access – Timing in Study Period

Figure 2 show the number of hits for each calendar week in the study/exam period. This hit show the aggregate of all lectures topics accessed, e.g., the hits in week 3 include downloads of topics 1, 2, and 3 made in the third week of semester.

For first years, the number if accesses per calendar week oscillated around 175 per week with two pronounced spikes and one moderate dip in accesses. The first and smaller of the two spikes was around weeks 2-3, early in the semester. Following this spike access was fairly stable up to and through the study break. Accesses the dipped in weeks 8 and 9, which coincided with the submission of the major assignment for the unit (end of week 9). Accesses the returned to pre-assignment levels then spiked sharply in weeks 14 and 15, the exam for this unit falling in week 15.

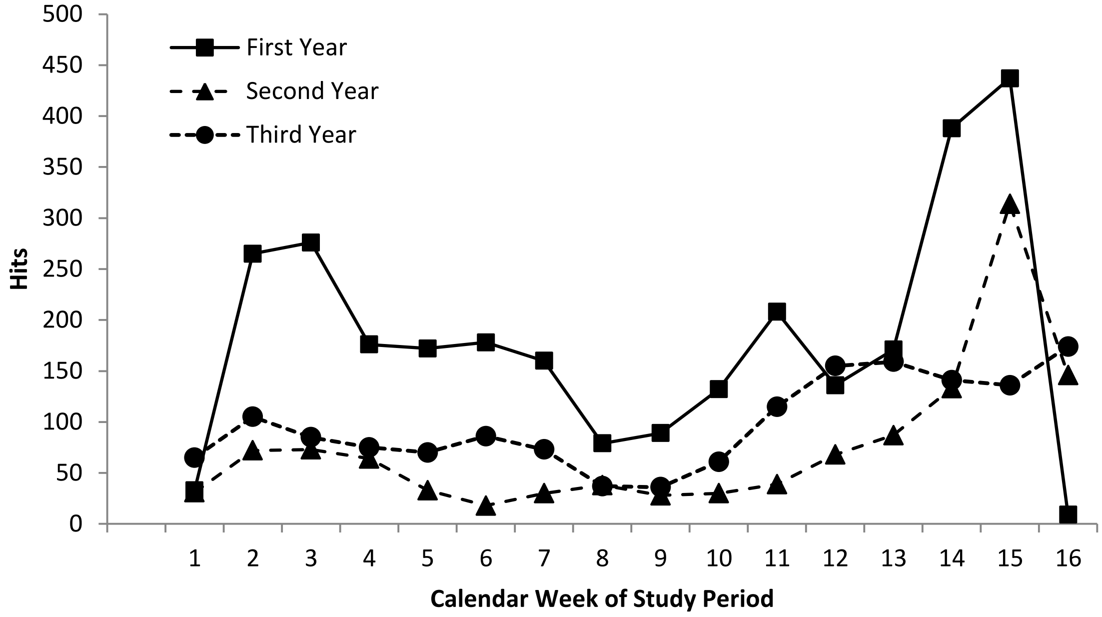

Figure 2: LC download hits for each week of the teaching and exam period for 1st, 2nd, and 3rd year students.

Although second year students had similar week-of-access pattern to first years there are some important qualitative differences. Second years showed the same initial surge in accesses early in the semester, however, this was smaller than the first year surge, possibly due to the failure of the first recording. There is some evidence of a dip in access coinciding with the weeks of assignment submission (week 6 and 9), although this is much less pronounced than the dip at this time in the first year plots. Notable is the enormous spike in accesses during the exam period.

Third year students had an access pattern similar to the second years but varied in magnitude. The same dip in accesses in the weeks preceding the major assignment was observed along with a very large spike in accesses during the study period. The initial surge of accesses at the start of the semester was much smaller than other year levels and arguably not clearly evident. There was a very pronounced swell in accesses in the last few weeks of class, similar pre-exam period wells and exam period spikes can be seen in first and second year but are much more pronounced in the third year data.

Time of Day of Accesses

Figure 3 indicates the time of day accesses were made aggregated across lecture topic and week of semester. All three year levels showed very patterns in the way the accessed the recordings. Most LC accesses were made between 10am and 4pm, with a small lull or tapering off in accesses in the early evening followed. Small fluctuations in accesses are evident at different times 7pm and 10pm. Activity rapidly drops off at midnight, and very few accesses are made between midnight and 7am.

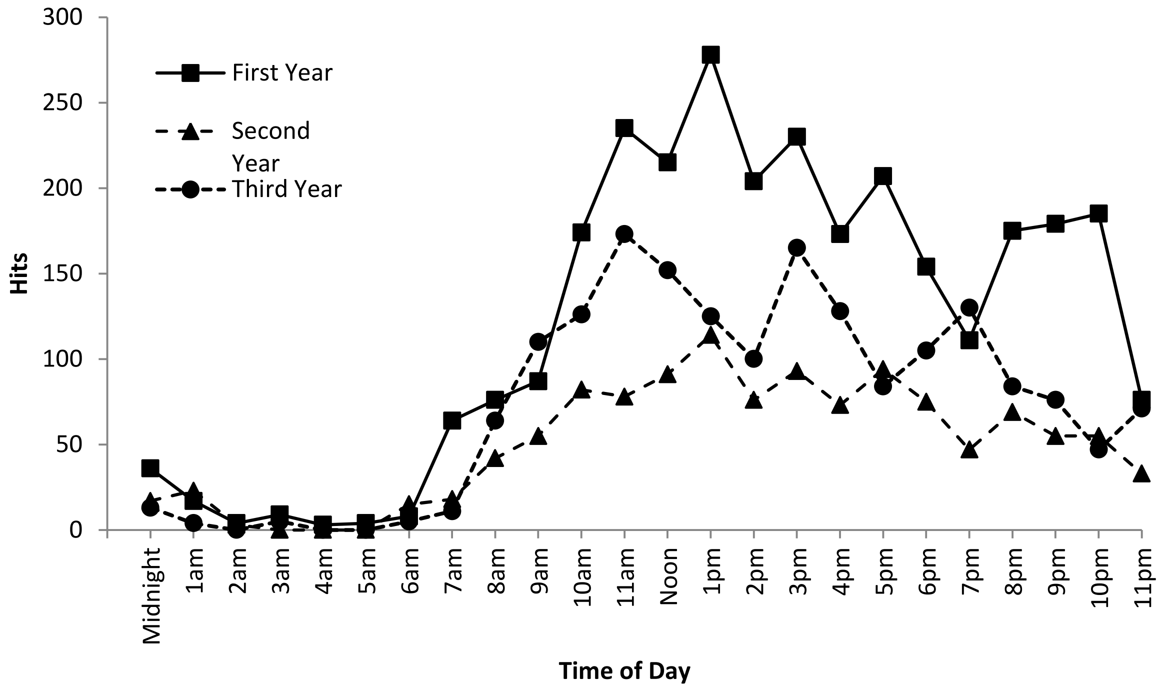

Figure 3: LC download hits by time of day for 1st, 2nd, and 3rd year students.

Phase 2 – Focus Groups

Although students were generally positive about the technical aspects of lecture recordings (quality, access, etc.) one of the main findings was strong differences between students concerning the purpose of lecture. Whether or not LC was seen as a useful tool depended on the student's ideas about the purpose of the lecture. Those who considered the main purpose of the lecture is for the lecturer to impart information to students consider LC to be a very useful tool. In contrast, students who considered the purpose of the lecture is to get students together considered LC to be a poor substitute. The majority of students acknowledged that LC availability played a role in the decisions to attend classes.

As with the student groups, while staff were generally positive about LC there were differences between staff on their views of the technology which were apparently related to their view on the purpose of lectures. Like students, staff who emphasised the transmission on information were generally positive towards it, however, those that saw the purpose of lectures as gathering students together and generating enthusiasm about the topics felt that LC was a poor substitute for face-to-face teaching.

Several staff expressed the concern that LC had the consequence of encouraging student to engage less with the course and affected attendance. One staff member commented,

> I think there are students who do see themselves as being very time poor and believe that they will review the content at another time. But looking at the stats, because I actually do look at all the stats from downloads – they don't [use it]! I think they convince themselves that it's there as a back-up, but they don't use the back-up as much as they should – that's one of the dangers I think of the technology; they fool themselves into believing that it's a safety net.

Staff also expressed concerns related to copyright issues and potential unintentional copyright infringement. One staff member remarked,

> [LC] does change the curricula in terms of copyright, because there's a lot of material we can't broadcast because of copyright restrictions. I think my lectures have become dull because I'm cognizant of the copyright requirements and I have to take out stuff that I would normally have in lecture."
> Some staff remarked that they did not use or like to use LC because of the thought of being recorded, as one staff member said "I don't like the feeling myself of being an a stage and recorded, it makes me feel uncomfortable and I don't feel like I can be myself.

Phase 3 – Student Survey

Some basic demographic information for the respondents is given in Table 1.

Table 2: Year of Study and Average Grade for Respondents

Student Characteristic	% of respondents
Year of Study	
1st	50.9
2nd	14.0
3rd	26.3
4th	3.5
Not given	5.3
Average Grade	
High Distinction	14.0
Distinction	50.9
Credit	26.3
Pass	5.3
Not given	3.5

Although the age and gender profile of the sample was representative of the student body, year of study and grades were not: 2nd year students were significantly underrepresented and first year students slightly overrepresented; students obtaining distinction grades were heavily overrepresented, while students obtaining passes were significantly underrepresented.

Ninety-one-point-two per cent of respondents reported having accessed LC recordings while studying, with exactly one third or respondents indicated that LC was available for all their units, the remainder – bar two respondents who had never heard of LC - indicating that LC was available for only some of their units. Students were asked what usage pattern best described their use of LC, their responses are shown in left two columns of Table 2.

About four fifths of respondents indicated that they tried to attend all lectures and used LC to make up for missed lectures or for revision. Nearly one fifth, however, indicated that LC was used in place of lectures. The respondents who indicated they used LC somewhat were asked what their reasons for doing so were, these responses are summarised in two rightmost columns of Table 2.

Table 2: Students' Style of LC Use and Reasons for (not) Using LC

Usage Style	%	Reason for Use/Non-Use	%[c]
I try to attend all lectures and *not* use LC	7.0	*Reason for LC Use*[a]	
I try to attend all lectures and use LC as a back-up for lectures I miss	42.1	Missed Lecture	68.4
I try to attend all lectures use LC for revision	29.8	Study for examinations	64.9
I use LC *instead* of attending lectures	17.5	Revise lecture material	63.2
I do not attend lectures and do not use LC	3.6	Better understand difficult concepts from the lecture	45.6
		Supplement notes made in lectures	33.3
		Better understand the lecturer	19.3
		Reason for Non-Use[b]	
		Never missed lecture, so don't need LC	26.7
		Unavailable for unit	20.0
		Poor audio quality, poor video quality	0.0
		Large download size	0.0

Note. [a] Reason for use includes only students who used LC. [b]Reasons for non-use includes only responses from students who do not use LC. [c]Respondents could give multiple reasons and thus percentages do not sum to 100

Aggregated, the majority of reasons students gave for using LC reflected a diversity of revision or post-lecture elaboration goals. The single most frequently endorsed reason, however, was using LC to make up for missed lectures. Noteworthy is that in a follow-up question specifically asking about missed lectures 57.9% of respondents indicated that they intentionally missed lectures because they knew they would have access to LC.

Interestingly, students who did not use LC to miss lectures got high distinctions (18.2% vs 12.1%) and distinctions (54.5% vs 51.5%) more frequently than those who used LC to miss lectures. Those who used LC to miss lectures received credits more frequently than those who did not skip lectures knowing that LC would be available (30.3% vs 22.7%).
Those who did not use LC did so because they felt they did not need it or that it wasn't available. No respondents cited quality and download size as a barrier, but most non-users did not provide a reason for non-use from the list of option or in an open-ended response.

Discussion

Lecture Capture Usage Patterns
In interpreting the results and framing this discussion we reiterate three: LC was available for all the units surveyed in this study; while the age and gender of the sample was representative of the student body, high achieving students are overrepresented in this study; this study only surveyed students enrolled in face-to-face programs.

The access data from Phase 1 of the study indicates that students of all year levels in the psychology major have very similar LC access pattern, with first years showing perhaps more initial enthusiasm for the technology, but their use of it waning more quickly. For all year levels LC accesses drop over the first few weeks of classes, suggesting an initial energetic engagement followed by a more sustainable stabilisation of study habits. All year levels also show reduced LC access when large assignment deadlines are approaching, suggesting that students are focusing their efforts on grades and may studying lecture material less in this period. All year levels show the heaviest access during the exam period and these are mostly accesses of the oldest (i.e., first few) lectures. Noteworthy is that the majority of accesses happen in work hours and the "traditional" even study period. The majority of students are not using the flexibility afforded by the system to work "out of hours." A relatively small percentage of students are accessing the system out of hour, and further research is needed into the demography of this group. While there is some steady LC traffic associated with in semester study, this pattern of usage combined with the results of the Phase 3 survey indicate that our students are primarily using LC as a revision tool, with only a small minority using it in place of lectures. Our conclusion that LC seems to be used primarily for revision is broadly consistent with many past studies on LC use (e.g., Copley, 2007), however, this study has provided some additional insight into how this is integrated in students' study plans. Further work is needed to fully understand how LC access patterns relate to specific study habits.

The apparent discrepancy between the reported usage patterns/intentions and stated reasons for using LC (e.g., few students intend to skip lectures, *yet* this is the single biggest reason given for LC use, *but* revision is the most common actual use) provides a good illustration of how the framing of questions can shape responses and interpretation of those responses. Multiple data collection methods also help to understand the broader picture.

The conclusion that students use LC primarily for revision is not inconsistent with the possibility that LC may negatively affect lecture attendance. Phase 2 student interviews confirmed the belief that LC plays a role in absenteeism, and the Phase 3 survey provided evidence that the intention to use LC in this way was associated with slightly lower grades. The number of downloads of the later lectures in this study is not commensurate with the number of absences from class. There is a gap between some students' intentions and actions, and we must be mindful that while students use LC to revise for exam and make up for missed classes, LC may provide students with lower motivation or time management problems a false comfort. This inference can be further underscored by noting that higher achieving – and presumably more engaged - students are over-represented in this study and we know much less about what the weaker students are doing.

Pros and Cons of LC in Flexible Learning
We respect and defend students' right to shape their own learning and make use of technology to create flexible study options. This flexibly has opened up education to many who would have been denied access in a previous age. This said, many lecturers are now asking themselves whether we have an obligation to narrow "choice" somewhat in service of providing better learning designs and thus better student outcomes. It is widely recognised in the health professions that clients do not always do what is in their best interests. Relatively little formal empirical work has investigated this possibility in education, but similar patterns pertain in some well-controlled studies (see, for example, Ariely & Wertenbroch, 2004). We wonder whether lecture attendance, engagement, and ultimately grades would be higher if LC were not available immediately after the live lecture, but provided somewhat later for revision purposes. We also wonder whether the small number of students who may be deliberately using LC as an attendance substitute might not be better advised to enrol in online versions of unit (where available) specifically designed to support learning in the absence of lectures. In the short term

we intend to report the results of this investigation to our students as strong advice on effective study habits and allow them to make an informed choice about their LC use.

Lecture Videos, Copyright, and Teaching Style

Sections VA and VB of the Australia's 1968 copyright act allow certain restricted reproduction of audiovisual and print media for students enrolled in units, however, it is not entirely clear whether the videotaping of presentations that include copyright media (e.g., pictures and artwork) constitute a copyright infringement. Presentation of printed material or artwork in lecture overheads and notes is usually permissible, but technically video recording of the same lecture is not a print reproduction under section VB, rather it is a "broadcast". This does not present a problem for producing lecture notes and audio-only lectures. Nor is it a problem where the visual content has been authored by lecturers, however, most lecturers legitimately use clip art and textbook publishers' materials, which they are increasingly reluctant to include in capture presentations. Few lecturers have the skills or resources to produce all their own art, and uncertainly over the status of video capture of copyright art plus high student demand for LC is prompting some lecturers to deliberately downgrade their teaching materials to avoid inadvertent copyright beaches. Although overcoming self-consciousness is part of every lecturers' professional skillset, LC adds an additional layer of self-monitoring (and possibly unnecessary self-censorship, if the video may be used outside the initial delivery for which it was intended) which can impact lecturer's well-being and alter their teaching style. These issues have significant implications for both teaching quality and course development budgets.

Technical Limitations with this Study and Learning Analytics Involving Videos in Live Courses

Using hit counters to track how many times students access lecture videos has some important limitations for research and teaching. It is widely recognised in the social sciences that most measures indirectly or imperfectly capture the constructs of interest. This limitation is salient for data sources like opinion and retrospective activity surveys where the limitations of human memory or the desire to present oneself in a positive light can clearly bias responses. Click data from websites, the grist for the mill of learning analytics systems, is comfortingly objective and appears to avoid such problems. However, web users will be aware that clicking on an article is not the same as reading it. Hit data on lecture videos only tells us that students are clicking on video links, not what they are doing with them. The correlation between clicks (observable) and views (not observed) may be sufficient to drive broader aspects of course planning and learning analytics software but is probably not sufficient for building good theories of online learning and may have far reaching implications for teaching budgets and completion rates. The only obvious way to objectively and remotely track video usage is to force students to stream (rather than download) recordings and implement a software layer to track how the stream is used. This approach has been used in one study (von Konsky, et al., 2009) and reveals interesting usage patterns. This sort of monitoring software is not standard in most systems and the data it generates is not as straightforward to analyse as click/access data. The LC system used in our study can be configured to allow streaming only. This has some pros and cons. The main pro is that it allows the institution to retain control of its videos – they can be watched but not saved. However, the requirement to stay connected while watching said videos frustrates some viewers (this has been reported to one of the authors) who want to download it to a device (presumably one that is not itself web-enabled).

It is likely that there is a considerable body of grey literature on this topic, such as institutional reports, which may render out literature review a somewhat distorted view of the topic. It is possible that the peer reviewed literature is incomplete. This implies means educators have only limited data outside their own experience to draw on which underscores the importance of publishing papers such as the present one published in accessible places.

Conclusion

A danger with making any sort of recommendation is that one size does not fit all. The diversity of past findings and the results of this study certainly do not provide definitive advice for deploying and integrating LC technology in learning designs. Nor is there likely to be a perfect solution – like most human behaviours, many contextual and historical factors operate to shape outcomes. Because of this we encourage instructors and researchers alike to continue publishing short empirical papers on LC use so that structured reviews and meta-analyses can progress toward divining some of the technological-, student-, and course-related factors that have the biggest impact on effective learning in courses that use LC. At the risk of making unilateral prescriptions, the following general conclusions are be cautiously advanced regarding LC as a supplement in face-to-face courses: There is little evidence that the provision of LC has consistent large negative effects on lecture attendance for typical students – attendance effect depends to some degree on student intentions, attitudes (e.g., beliefs about what lectures are for), student attributes (e.g., year level), course design elements (e.g., activities that instructors do in face to face classes), and effective use of technological add-ons (e.g., video bookmarks, integrated quizzes). Data to date suggests that on-campus students do not routinely use videos as lecture replacements, but use them primarily as revision and study tools. LC seems to benefit stronger students and students who watch videos in addition to attending class

LC can democratise some aspects of learning and allow students flexibility. It tends to benefit good students but may be a motivational detriment to poorer students. LC seems to provide benefits when it has a clear purpose articulated in the course design or are used in healthy study habits. Availability of videos does not ameliorate the effects of poor course design or bad study habits. Therefore, as instructors when we need to make clear statements to students about how we believe videos (and other technology) can most effectively be used for and impress upon them means of integrating them into their study plans. The effectiveness of a particular technique or technology is highly dependent on context. We encourage researchers to continue publishing details of how specific course content, student characteristics, and technological allowances interact so we can create the best possible teaching and learning outcomes in the future.

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AUTHORS INDEX