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of the Australasian Society for Computers in
Learning in Tertiary Education

Who's Learning? Whose Technology?

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Volume 2

Editors: Lina Markauskaite, Peter Goodyear, Peter Reimann

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The papers in this book comprise the proceedings of the 23rd Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education “Who’s Learning? Whose Technology?” Volumes 1 and 2 of the proceedings include selected full research papers. All papers are original, peer-reviewed and based on the research originally disseminated at the meeting. Papers presented at this annual scientific conference reflect the state of the art of research and development in the area of computer supported learning in tertiary education in the Australasian region. The selection of scholarly papers for presentation and publication was based on the outcomes of a rigorous peer review process. Papers reflect the authors’ opinions and their inclusion in this publication does not necessarily constitute endorsement by the editors. The Appendix comprises other selected conference materials: keynotes, special sessions, symposia, poster presentations and workshops, which are not full scientific papers.

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Volume 2

Research Papers

You, me and iLecture

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This paper explores the implementation of iLecture for a second year accounting unit at Macquarie University. The research found that students interacted with iLecture in ways that were not entirely expected. Students appear to want more control over their learning environment and technologies. An example of this is iLecture as it has the potential to provide students with choices about how and where they learn. The majority of students that used iLecture also attended face-to-face lectures. Teaching staff also used this technology to listen to lectures before tutorials. This assisted with the constructive alignment of lectures and tutorials for the large number of staff involved in the unit. We argue that understanding how students are using new technologies such as iLecture, and the lecturers' experience of iLecture, could provide useful insights into how academics can utilise these technologies to provide a more fulfilling interaction with students.

Keywords: teaching and learning strategies, emerging technologies, ICT policies and strategies, iLecture, ICT, teaching, higher education

Introduction: Technology tensions

Academics have conflicting and, at times, contradictory roles. Academics are under pressure to have an active research program as universities strive to lift research performance (Dunkin, 1999). At the same time, academics are under pressure to provide high quality teaching. Academics must find ways to be more efficient and effective in how they approach the teaching component of their work to be able to provide a high quality product while, at the same time, build a credible research profile.

Students are demanding more value for money as they are expected to contribute more financially towards their education. Students expect a high quality education that will provide them with a satisfying career. Employers argue that graduates do not have the skills and competencies required for the workplace and there is considerable government pressure for greater returns for the education dollar (Coaldrake & Stedman, 1998; Dunkin, 1999). To stay viable, universities need to align their programs to the external world from the professions, from university management and society (McShane, 2004; Coaldrake & Stedman, 1998). Due to globalization, universities are increasingly part of an interconnected, educational network, with many Australian Universities relying heavily on finances from international students. This, in part, has been catalysed by the marketisation of higher education by Federal Government during the 1980's, where the predominating philosophy was economic rationalism, where education is a commodity rather than a social good. The consequence of international fee deregulation in 1985, resulted in an increase from 24,998 international students (predominantly from Chinese families) in 1990, to 83,047 in 1998. Australia is the third largest provider of international education in the world, behind the US and UK (Marginson, 2002). Fee paying students have many different expectations of university and what constitutes quality education. With the payment of university fees, they may be viewed as even more powerful and influential stakeholders then previously. Coaldrake (2002) notes that teaching in universities to-day is more a 'mass' activity rather than an 'elite' activity. The change in the student profile, the change in government demands for quality assurance and accountability, coupled with the changes in ICT, are transforming how students are taught. In particular it is decoupling the need for student and teacher to occupy the same time, space and place (Ahmad, Piccoli & Ives, 1998). To meet these demands, the quality of teaching has to be of a very high standard.

Students have mixed reactions to the implementation of ICT. Some students resist the use of technology if they believe it will reduce the amount of interpersonal contact with academic staff. Students also complain that they are overwhelmed by information (Sutherland & Badger, 2004). On the other hand, if students believe it enhances the learning experience, they are more likely to embrace it (Dunkin, 1999). We have limited understanding of how students are using new technologies as most studies are still taking place (Sutherland & Badger, 2004). Some academics see ICT as enhancing the student learning experience. For example, ICT can provide academics with the tools to interact with students in a more flexible way and support a more student-centred approach (Bennet & Lockyer, 2004; Taylor, 1998; Collis & Moonen, 2001). Others believe that ICT, rather than enhancing the student and lecturer experience, is a poor substitute for face-to-face interaction (Dunkin, 1999). One consequence of using ICT is that the lecturer and the material that they teach become more visible and fixed (Coaldrake & Stedman, 1999; McShane, 2004) which could be an unsettling experience for the lecturer.

One way that academics have been attempting to address some of these tensions is by utilising online management software, such as WebCT or BlackBoard, that provide an online environment for academic staff to supply lecture notes, quizzes, discussion forums, assignment submission, student grades and related information for students to access twenty four hours a day, seven days a week. Another key development has been the recording of lectures which can be downloaded by students in formats such as MP3. The leading lecture capture system in Australia is iLecture (also known as Lectopia) (Williams & Fardon, 2005). We have little understanding of academics perceptions of ICT and how this changes the way they undertake their work (McShane, 2004) and this includes more recent innovations such as iLecture.

Understanding how students are using iLecture and the lecturers' experience of using this technology could provide useful insights as to how academics can utilise ICT to provide a more fulfilling interaction with students. This understanding may enhance our understanding as to how lecturers' roles are changing and how this technology could be used to create a more effective work environment for academics while providing enhanced learning opportunities for students. This paper explores the implementation of iLecture for a second year accounting unit at Macquarie University and addresses two research questions. The first was to examine how user-friendly the students are finding iLecture by asking them about their perceptions when using the technology. The second was to explore the lecturers' experience while using iLecture by using the lecturers' reflective journals throughout the semester. Both perspectives are important when assessing the overall effectiveness of this technology and how it can be better integrated into teaching and learning strategies.

Teaching and learning context

The iLecture system was developed by the University of Western Australia (UWA) in 1998. The overall aim was to develop and implement an automated lecture recording system that a student could make use of at any time, and from anywhere. At UWA, iLecture is mostly accessed through WebCT (Williams & Fardon, 2005; Fardon & Ludewig, 2000). The use of iLecture at UWA has increased significantly since it was implemented. In 2004, over 200 lecturers had their lectures recorded and this was expected to increase in 2005 (Williams & Fardon, 2005).

Macquarie University implemented iLecture at the beginning of semester 1, 2005 to replace the reel-to-reel analogue recordings that the University used for many years. For this first phase, the University implemented the audio digital capture and delivery components of the system. This phase provided the ability to upload lecture notes such as PowerPoint slides that were available when the student downloaded or streamed the lectures. The University plans to implement video and other projected material in the future. Lecturers choose whether or not they implement iLecture. There is no pressure by the university or management to use iLecture.

The findings in this paper relate to a second year compulsory unit, ACCG250 Accounting Systems Design that introduces students to accounting information systems using social and organisational perspectives of information systems. The unit also builds competency based vocational skills. It is an issues-based as opposed to technical-based unit. The main topics included:

- introduction to accounting information systems, the technology of information systems, and some of the formal ways to document systems;
- a consideration of transaction processing systems, with a particular focus on the accounting software package MYOB; and databases and data modelling;
- an examination of controls used in accounting information systems;
- a discussion of computer crime, and ethics, as they pertain to information systems;

- an exploration of the processes of systems planning and development;
- an introduction to information and knowledge processing systems (including decision support systems), and electronic commerce.

The unit was presented face-to-face via the traditional lecture (two hours) and a one hour tutorial. In comparison to the previous semester, the prescribed text and the unit outline were the same and assessment tasks were similar in format (two online multiple choice review quizzes, two MYOB assignments and an attendance/participation mark).

There were several changes made to the unit in Semester 2, 2005, one of which was the introduction of iLecture which was available via the unit WebCT site. Other changes included the activation of the WebCT discussion board, release of guideline solutions for tutorial questions and a mock exam. WebCT was used in ACCG250 for discussion forums including announcements, uploading of assignments, uploading of lecture notes, and tutorial questions and answers (delayed), resources such as eReserve in the library, access to a mock exam and answers (delayed) and iLecture. The main reason for implementing iLecture in ACCG250 for semester 1, 2005 was so that students could have the flexibility of listening to lectures anytime they chose. It was not intended to replace the face-to-face lecture per se but to provide a way of obtaining access to the lecture if the student was unable to make the face-to-face times. That is, iLecture was seen by the lecturers in the unit as providing an enhanced learning experience by providing additional options to students.

The lecturers assumed that providing iLecture in ACCG250 would improve the student's learning experience by providing multi-media resources for learning. The student cohort was 828 students for semester 2, 2005. Ensuring quality of learning experience across a large student cohort with limited resources lends itself to the use of ICT (Freeman, 1996), particularly when communicating consistently across such a large number of students. The delivery of this unit changed from providing only face-to-face lectures and tutorials, to include recording of the lecture through iLecture, and use of the discussion board. This placed ACCG250 on the learning continuum towards a flexible, hybrid model of delivery. This type of delivery is a blended mode of face-to-face and distance education. This mode of delivery opens opportunities for student-focus learning in contrast to a teacher-focus, where the constructivist paradigm of increased student control over what and how they choose to learn is possible.

According to Coaldrake (2002) an important student expectation is the concept of flexibility and convenience through a 'telepresence' where students can access information 24/7. Investigation into whether iLecture delivered on these expectations was examined in this research. Factors impinging on why students chose to use iLecture were also investigated. As many students within this unit came from a non-English speaking background, we felt that this may be a contributing factor to the use of iLecture. The purpose of use was also analysed, including the use within a learning context. Traditional face-to-face lectures tend to be teacher focused, where the locus of control is with the teacher (Jones & Paolucci, 1999) and there is debate as to whether the traditional lecture is an effective teaching mode of delivery. There are a wide range of views as to what lecturers believe lectures are meant to achieve and how they should be delivered (Sutherland & Badger, 2004).

iLecture is the audio and visual (PowerPoint slides) of a lecture. Due to its flexibility in delivery, where the student has control over the material, there is shift in emphasis from the teacher to student learning (Nunan et al., 2000) if students use this technology. According to Alexander (1999), the educational goal of most flexible delivery and learning is to increase student learning outcomes by increasing student engagement (Dowling et al., 2003). Students now have the option to revisit difficult concepts, the convenience and flexibility of ICT provides them with the opportunity to take responsibility for their own learning. The possible implications for lecturers include whether they need to reconsider their teaching style so as to incorporate iLecture listeners, and whether attendance to lectures will be considerably lower, as students may opt to substitute the lecture with iLecture.

The students' perception of their learning experience with iLecture was the second main objective for this research. There is extensive literature on the perceptions of teachers however there is scant information from the perspective of the learner. As learning and teaching cannot take place without the learner, and given the increasing importance of student's expectations, understanding their attitude towards this technology, given the large capital expenditure, should be deemed as important and relevant when considering future ICT educational projects. In particular, there was a comparison made to the traditional face-to-face lectures and the use of iLecture in learning. Understanding students' preferences given the different models of delivery is important to understand so that lecturers can change their teaching style to include these students. Students were asked if they felt that face-to-face lectures offered a better learning experience than iLecture and if they felt that this subject was better with iLecture when compared to subjects without this technology.

Methodology

A multi-method approach was taken to investigate the different perspectives of teachers and students. Students were administered a questionnaire based on the usage and perceptions of learning experience with iLecture. The questionnaires were distributed in week 12 by the tutors in tutorials. Reflection journals were the information source from teaching staff on their assumptions and experience with iLecture throughout the semester.

Student questionnaires

There were 828 students enrolled in this unit, with Table 1 indicating the apportionment of unit enrolment by domicile. As can be seen, 24% of students were domestic and 76% were international.

Table 1: Total students by domicile

Domicile	Number	%
Domestic	202	24%
International	626	76%
Total	828	100%

A pilot questionnaire was administered to 62 students to test the reliability of the questions, and to amend and refine any questions that were perceived to be ambiguous. After the initial pilot and the appropriate amendments were made, the questionnaire was given to tutors for students to fill-in during the tutorial time. The number of respondents from 828 students was 411 (49.6%). Initially students were asked if they had used iLecture. If they had never used iLecture they were subsequently asked why not and then these students were not included in further analysis on students' perceptions of iLecture, as this analysis was based on the premise that students had at least experienced iLecture.

Questions were asked in regard to usage of iLecture. Intentions behind these questions were to understand if students were utilising iLecture as a means to replace lectures, in concordance with how a distance education student would use this material, or if they were using iLecture conjointly or in tandem with face-to-face lectures. Implications for use of ICT may impact future delivery of teaching. Learning styles and teaching pedagogy may need to be reconsidered if a substantive portion of students are using iLecture as a means to conduct distance education.

Lecturers' reflection journals

Although we live in a knowledge economy, acquisition of knowledge is in itself is a shallow pursuit, if engagement, understanding and critical evaluation on a deeper level of our teaching is not constantly reflected on. Reflection can be very productive and aids teachers to gain insight through self-directed evaluation (Calderhead, 1989). Dewey (1933) defined refection 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).

A reflection journal is a tool for improvement, where assumptions and issues can be explored in detail. It is a communicative medium, which will hopefully enhance and contribute to personal understanding and skill development by focussing on what the strengths and weaknesses are of different teaching approaches and, hence, where there are opportunities for growth or change. It is also a means to anticipate personal, institutional, and environmental changes and identify ways in which these changes will impact students and teachers. Reflective journals communicate workplace learning. Workplace learning is about being willing to extend yourself, re-adapt yourself, and constantly challenge yourself by being open to new ideas and experiences. Through this process, it is hoped that the reflection journal improves teaching and hence will result in quality outcomes for the students. A reflective journal was kept by the main teaching staff of this unit and extracts were taken to highlight the expected and unexpected issues of the iLecture application.

Results

Student questionnaires

Although face-to-face attendance was not compulsory, it appeared that the majority of students were not replacing the traditional lecture with iLecture. The attendance of students at face-to-face lectures remained relatively high and constant throughout the semester. Tables 2 and 3 show comparison of iLectures to traditional face-to-face lectures.

Table 2: The traditional face-to-face approach offers a better learning experience than iLecture

Stance	Count	%	Cum %
Strongly Agree	72	22.22%	22.22%
Agree	96	29.63%	51.85%
Neither	132	40.74%	92.59%
Disagree	20	6.17%	98.76%
Strongly Disagree	2	0.62%	99.38%
No Response	2	0.62%	100.00%

Table 3: iLecture enhanced this course compared to other subjects that do not include iLecture

Stance	Count	%	Cum %
Strongly Agree	97	29.94%	29.94%
Agree	148	45.68%	75.62%
Neither	58	17.90%	93.52%
Disagree	19	5.86%	99.38%
Strongly Disagree	1	0.31%	99.69%
No Response	1	0.31%	100.00%

Students either agreed or strongly agreed that traditional face-to-face lectures were a better learning experience than iLecture (51.85%). Students also agreed or strongly agreed that iLecture was an important component of the unit (75.62%). Students are, therefore, not replacing face-to-face lectures with iLecture for all of the lectures throughout the semester. It is interesting to note that 40.74% believed that *neither* provided a better learning experience – an area that will need further clarification in future research.

Table 4: Factors contributing to usage

Factor	Count	%
Disability	5	1.28
N.E.S.B*	137	34.95
Carer	20	5.1
Work commitments	56	14.29
Sickness	76	19.39
Enrolled part-time	12	3.06
Extended travel time	86	21.94

Note. *Non-English Speaking Background

The majority of students who used iLecture came from non-English speaking backgrounds (34.95%), which was expected (Table 4). Some had a long time to travel to get to the campus (21.94%), which can be difficult with public transport in non-peak times. Rising petrol prices may increase this factor in future semesters, with some students opting to stop using their cars. Illness and work commitments were other reasons (19.39% and 14.29% respectively) that students reported for using iLecture. As more students have to contribute financially to their education, many are in a position that they will have conflicting demands and responsibilities such as work. The Federal Government's WorkChoices Legislation (Workplace Relations Amendment (Work Choices) Act 2005) may also have an impact on this aspect of students' lives. If, as predicted by some commentators, unskilled workers will have less choice about hours and conditions, then students working in casual positions may not have the flexibility to attend lectures even if they would like to (Costello, 2005).

Table 5: Reasons for usage

Reason	Count	%
To Check over notes	116	17.76
To playback hard concepts	127	19.45
To revise for exams	81	12.4
Listen to other lecture for same subject	21	3.22
Alternative to face-to-face	119	18.22
Make-up for missed lecture	189	28.94

The students used iLecture predominantly to catch up on occasional missed lectures (Table 5). Many students have work and other commitments which potentially impinge on being able to attend a face-to-face lecture (28.94%). Some students used iLecture instead of attending a face-to-face lecture (18.22%). Students attended face-to-face lectures and also used this technology to check over notes (17.76%), playback hard concepts (19.45%), revise for exams (12.4%) and catch up on an occasional missed lecture (28.94%).

Table 6: Duration and class matrix of usage

	<5mins	*5-10mins*	*10-30mins*	*>30mins*	*Entire lecture*		*Total*	
	1	*2*	*3*	*4*	*5*	*NR*		
1-2classes	3	19	29	23	31	1	106	**32.72%**
3-5classes		9	19	25	52	1	106	**32.72%**
5-7classes			8	13	20	1	42	**12.96%**
7-9classes			3	10	19		32	**9.88%**
9-11classes		1		6	30	1	38	**11.73%**
Total	3	29	59	77	152	4	324	
	0.93%	**8.95%**	**18.21%**	**23.77%**	**46.91%**	**1.23%**		

Note. n = 324; 78.83% used i-lecture at least once or more.

If students used iLecture, they listened to between 1 and 5 lectures (65.44%) (Table 6). Those that listened to 1 or 2 lectures listened to between 5 minutes and 30 minutes (69.8%) while 29.2% listened to the whole lecture. Those that listened to between 3 and 5 classes, half listened to the whole lecture and the other half listened to between 5 minutes and 30 minutes. Those that listened to more lectures tended to listen to more of the lecture which indicates that these were the students that did use iLecture as an alternative to attending face-to-face lectures. This suggests that the students that only listened to a partial lecture were checking over notes or playing back hard concepts.

We found that 21.17% did not use iLecture at all (Figure 1). For those students that did not use iLecture, 16.67% were adverse to using technology. This was a surprising finding as the students in this unit are future professionals that will be expected to interact with technology in the business world.

Table 7-10 show students' perceived qualitative learning outcomes. Overwhelmingly, students perceived using iLecture as improving the quality of their education – 73.15% either agreed or strongly agreed. Students clearly perceived that the learning experience was enhanced by having iLecture available (agree or strongly agree 78.39%). Students perceived that iLecture provided them with a better understanding of the topics in the unit (agree or strongly agree 70.37%) and that it was an effective learning tool (agree or strongly agree 84.26%). For these questions, a very small number of students disagreed that the quality was not enhanced. This indicates that students value having iLecture available to them to use if they choose to use it. Students perceive that iLecture provides them with an enhanced learning experience. It may be that by offering students a choice - they can use iLecture rather than attend a face-to-face lecture - they feel more in control of their learning environment and more likely to engage in their education.

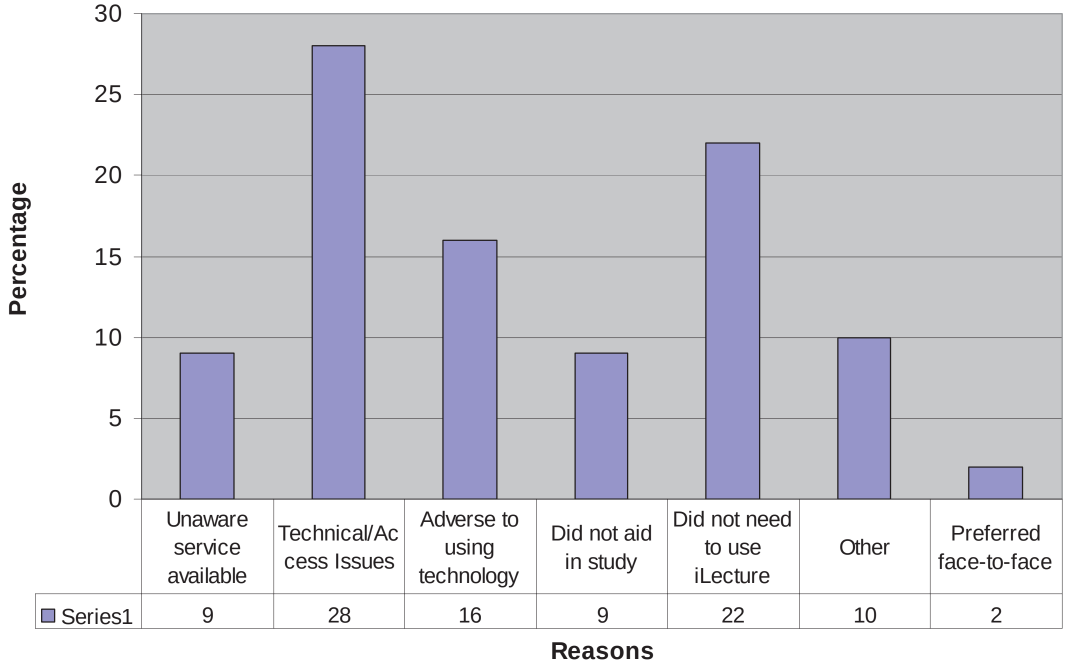

Figure 1: Reasons for not using iLecture

Table 7: Using iLecture increases the quality of your education

Stance	Count	%	Cum %
Strongly Agree	61	18.83%	18.83%
Agree	176	54.32%	73.15%
Neither	74	22.84%	95.99%
Disagree	13	4.01%	100.00%
Strongly Disagree	0	0.00%	100.00%

Table 8: iLecture improves the learning experience

Stance	Count	%	Cum %
Strongly Agree	57	17.59%	17.59%
Agree	197	60.80%	78.40%
Neither	56	17.28%	95.68%
Disagree	14	4.32%	100.00%
Strongly Disagree	0	0.00%	100.00%

Table 9: iLecture has provided a better understanding of the subject

Stance	Count	%	Cum %
Strongly Agree	49	15.12%	15.12%
Agree	179	55.25%	70.37%
Neither	79	24.38%	94.75%
Disagree	15	4.63%	99.38%
Strongly Disagree	1	0.31%	99.69%
No response	1	0.31%	100.00%

Table 10: iLecture is an effective learning tool

Stance	Count	%	Cum %
Strongly Agree	57	17.59%	17.59%
Agree	197	60.80%	78.40%
Neither	56	17.28%	95.68%
Disagree	14	4.32%	100.00%
Strongly Disagree	0	0.00%	100.00%

Students thought that iLecture is more convenient than attending a face-to-face lecture – 53.09% agreed or strongly agreed (Table 11). This does not necessarily mean that students used iLecture rather than attend a face-to-face lecture, rather that they believed it to be more convenient. Students overwhelmingly believed that flexibility was an important factor when using iLecture to learn effectively – 89.81% agreed or strongly agreed (Table 12). This is consistent with students wanting to have more choice over their learning environment.

Table 11: Listening to iLecture is more convenient than attending a face-to-face lecture

Stance	Count	%	Cum %
Strongly Agree	66	20.37%	20.37%
Agree	106	32.72%	53.09%
Neither	93	28.70%	81.79%
Disagree	54	16.67%	98.46%
Strongly Disagree	5	1.54%	100.00%

Table 12: i-lecture provides the flexibility you need to learn effectively

Stance	Count	%	Cum %
Strongly Agree	101	31.17%	31.17%
Agree	190	58.64%	89.81%
Neither	27	8.33%	98.14%
Disagree	6	1.85%	99.99%
Strongly Disagree	0	0.00%	99.99%

Lecturers' reflection journals

Teaching staff for ACCG250 included 3 full-time staff members and 10 part-time tutors. The Lecturer-in-Charge kept a reflective journal throughout the semester and as part of that journal reflected on the use of iLecture. In the first two lectures, it was noted that the lectures appeared to be full. After week 2 there were 238 hits for lecture 1 and 108 hits for lecture 2. This indicates that a number of students may have missed the first lecture. Anecdotally, students from overseas tend to start university in the second week of the semester as tutorials do not start until the second week. This may account for the large hit rate for lecture 1 after week 2.

After five weeks of teaching we undertook an independent teaching survey. The initial student feedback report (received without student comments in week 10) showed that the higher averages were in response to being able to access lectures online and use of discussion forums. This supports the questionnaire responses from students that iLecture was considered a valuable learning tool.

At the beginning of week 7, there were more hits for lecture 1 than the other five lectures. There were 499 hits for lecture 1, 386 hits for lecture 2, 390 hits for lecture 3, 270 hits for lecture 4, 252 for lecture 5 and 130 hits for lecture 6. The large number of hits for lecture 1 may have been due to a number of students not attending classes in the first week.

An unexpected benefit of using iLecture noted in the reflective journal was the teaching staff listening to iLecture. One tutor downloaded the lecture and listened to it on his iPod on the train going to work. Other tutors also reported that they also listen to the lectures before undertaking their tutorials. This is very useful as it ensures constructive alignment with the lectures and the tutorials and assists with consistency.

In week 10, there were a large number of hits for the earlier lectures. For lecture 1 (567 hits), lecture 2 (467 hits), lecture 3 (473 hits), lecture 4 (391 hits), lecture 5 (392), lecture 6 (359 hits), lecture 7 (350 hits), lecture 8 (215 hits), lecture 9 (190 hits), lecture 10 (173 hits). This indicates that the students are listening to the lectures using this technology, in particular the earlier lectures. We were unable to do the final lecture in week 10 due to a power outage in a lecture theatre – we referred students to iLecture which meant the students did not miss out on any content if they chose to listen to the lectures.

In the last week of the semester there were a large number of hits particularly for the earlier lectures. For lecture 1 (612 hits), lecture 2 (510 hits), lecture 3 (536 hits), lecture 4 (493 hits), lecture 5 (448 hits), lecture 6 (469 hits), lecture 7 (473 hits), lecture 8 (339 hits), lecture 9 (331 hits), lecture 10 (493 hits), lecture 11 (323 Hits), lecture 12 (330 Hits), lecture 13 (227 Hits). This number of hits indicates that a large number of students downloaded the lecture. It does not, however, guarantee that the student listened to the lecture, it is only an indication of how many downloaded it. The number of hits does give us some indication that a large number of students enrolled in the unit are able to download the lecture and listen to it if they choose. It also does not show us if the students listened to the lecture in its entirety or if they only listened to part of it.

On reflection it appears that iLecture is a technology that is perceived by students as useful and valuable. It also provides additional benefits by our large number of staff being able to access lectures if they chose to. Students that were unable to attend a lecture were still able to access the lecture in their own time (as well as the lecture notes).

Conclusions and future research

Academics have to find ways to develop better processes to improve the quality of teaching and learning as students, universities, government and industry demand value for money. ICT can assist lecturers in streamlining processes and assist in providing a quality learning environment. We need to understand how new technologies are being used and how they add value from both a student's perspective and a lecturer's perspective. It is important to understand both how students are using iLecture and how lecturers utilise it to achieve the most appropriate learning outcomes and provide more fulfilling interactions with students.

The way students use iLecture may not be in the ways we expect. Students have complex lives and need to make choices about is the most appropriate use of their time. Both international and domestic students have to make choices about the work that they undertake and balance other responsibilities. This becomes more complex for those students with careers and families. Students should be able to choose the most appropriate mode of learning for them and sometimes this will be face-to-face lectures and at other times it may be listening to a lecture on an iPod while doing something else. We found that many students attended the face-to-face lectures as well as used iLecture for varying reasons.

It will be important to monitor the use of iLecture and how lecturers use it. It is very likely that the way iLecture is used by students and lecturers will change as both become more familiar with its capabilities. If there is new functionality such as webcams for students to see the lecturer and/or lecture materials this may also change the way it is used.

Different units may have different experiences. It will depend on the type of material being taught, differing lecturing styles, the type of visual aids being used and the lecturer's personality amongst other things. It may also depend on the context with which iLecture is being used. In ACCG250 it was WebCT based – other units may not be taught in the same context. We also did not use iLecture to reduce any face-to-face teaching. Implementing iLecture was in addition to the face-to-face lectures and tutorials.

This research was exploratory and raised more questions rather than providing definitive answers. Further research will include monitoring how students are using iLecture in ACCG250 in subsequent semesters to ascertain if students are finding some value and if does change the way lecturers need to think about delivering their units.

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Beyond marks and measurement: Developing dynamic and authentic forms of e-assessment

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E-learning has transformed both pedagogy and learning environments and a new generation of learners has emerged, who require immediacy, connection and personalised opportunities for both formal and informal learning. Instead of using narrowly defined learning outcomes tested by examinations, social software tools offer scope for social connection and self-governed assessment tasks such as critical inquiry, collaboration and team work, giving learners multiple channels of expression, and perspective taking. While social software tools can be closely inter-woven with learning management systems, and be used to scaffold authentic tasks for assessment, there remain design and pedagogical challenges. The paper critiques current practice and analyses several examples of dynamic, resource-based, sustainable e-assessment that support lifelong and self-regulated learning.

Keywords: authentic assessment, dynamic assessment, e-learning, generic skills

Introduction: the need for critical pedagogical concern

The search for new modes of assessment is a key area of development in e-learning. According to current practitioners e-learning requires a qualitatively new pedagogy and the design of educative, authentic assessment tasks could be considered to be the most important element of tertiary teaching (Herrington and Herrington, 2006; Angelo, 1999; Huang, 2002). Traditional university education is being transformed from a "transmissive paradigm", emphasising the transfer of knowledge, to one where there is pressure to maximise the value of the assessment process in enriching the learning process and encouraging greater feedback. The associated assessment practices now focus on students' capacity to analyse their own knowledge, practice independent judgement and evaluate their own and others' performance. This view of learning and assessment is conducive to constructive, active learning where students take a pro-active role in questioning, sharing ideas and applying prior knowledge to new ideas. However, traditional university assessment tasks may not test for deep conceptual understanding (Anderson & Krathwohl, 2000). For example, an exam requiring recall of facts will encourage learners to adopt a surface approach, whereas e-assessment of collaborative problem-solving or teamwork also promote problem solving by giving the learner control over processes and outcomes. The aim of this paper is to provide examples of learner-centred forms of assessment utilising networked technologies and social software tools to support a diversified student population.

How social software tools support authentic assessment

As early as 1966, Bruner (1966, 34) commented on the power of technology – "emphasis should be placed on skills in handling, in seeing and imaging, and in symbolic operations, particularly as these are related to the technologies that have made them so powerful in their human expression". This statement prefigured the increased emphasis placed on generic transferable skills that have more recently required a re-alignment of e-pedagogies with desired learning outcomes (Oliver & McLoughlin, 2001). This implies that if self-regulated learning and critical skills are expected of graduates, assessment methods must foster such processes and skills. As institutions move increasingly to online delivery, there is ample evidence of the power of technology to support authentic assessment practices in on-line environments (Herrington & Herrington, 2006). Numerous commentators have remarked on the gradual infiltration of technology into schools, universities and workplaces, where software tools, self-paced learning packages and learning objects lessen the learner's dependence on the physical environment and the instructor. Learning and assessment are enhanced when participants are given the opportunity to create a kind of community where support, motivation and enjoyment are blended into the learning experience (Richardson & Swan, 2003). These ingredients are far removed from traditional and didactic pedagogies where disconnectedness and isolation were prevalent. Learning technologies provide an integrated environment where social software applications such as blogs, text chat, private and group spaces enable multiple forms of human discourse and collaboration. The term 'social software' is used in many different contexts, though the different technologies covered by the term have not been specifically developed for educational purposes. Anderson (2005, p4) has introduced the concept of 'educational social software' which he defines as:

> [...] networked tools that support and encourage individuals to learn together while retaining individual control over their time, space, presence, activity, identity and relationship.

As Anderson notes, social software is a very difficult concept to define. The term not only includes a wide range of different technologies, but the social aspect of the technologies often emerges from a combined use of different technologies. The examples of social software technologies which are being integrated into assessment tasks include weblogs, wikis, RSS feeds and collaborative tools. However, it is important to note that social software is in no way limited to these specific technologies.

The relevance of these developments to assessment design is that we can use the attributes of technology to create personal tools to enhance process skills, while developing autonomy and independence by designing authentic assessment tasks. In addition, by creating tasks as 'challenging learning events' that are self-governed, problem-based and social collaborative activities, educators provide a seamless integration with real life contexts (Sluijsmans, Dochy & Moerkerke, 1999).

User centred technology in support of assessment

The integration of online assessment tasks and tools has the capacity to support a wide range of learning goals and is becoming increasingly common in higher educational institutions across Australia (Byrnes & Ellis, 2006). Koper & Tattersall (2004) for instance suggests that many tools now employed in e-learning have a major role in supporting:

- self-directed learning and increased student autonomy
- the construction of personal representations of meaning-making
- increased information literacy
- intentional, mindful thinking and metacognition.

The transformative shift to a diversified student population characterised by self-direction and autonomy means that different pedagogies must be used to support the lifelong building of knowledge and competencies, enable students to assume responsibility for their own learning, have mobile and flexible to resources and be supported in developing skills in independent learning. Huang (2002) notes the challenges of applying constructivist approaches to online learning and that learning processes should be the focus of assessment, and an indicator of learner achievement. However, the quality of online assessment should adhere to the same principles that apply to authentic, student-centred assessment and that in all cases, it should be valid, reliable, fair and flexible, and include qualitative and quantitative approaches (Booth et al., 2003; Kendle & Northcote, 2000).

Theoretical perspectives on assessment

Several theorists and practitioners have written about the limitations of current forms of assessment, both face to face and online, labelling it as static, and questioning whether in fact, assessment does promote learning. Kozulin & Garb (2004) have signposted the inherent contradiction between the goals of student assessment and its means. The goal is usually to evaluate learning ability and to gain information useful for more effective instruction. The means, however, are often limited to measuring the students' current performance level. This contradiction was identified as early as 1934 by Vygotsky (1934/1978, Kozulin & Garb, 2004). Vygotsky believed that the normal learning situation for a student is a socially meaningful cooperative activity in a culturally supportive environment, mediated by peers and supported by tools and artefacts.

Cognitive functions such as thinking and learning abilities originate within this interpersonal interaction and only later are they internalized and transformed, becoming the student's inner cognitive processes. Thus under conditions of collaborative or assisted performance, scaffolded learners may reveal certain emergent functions that have not yet been internalized. According to Vygotsky, these functions belong to the Zone of Proximal Development (ZPD) in contrast to fully developed functions that belong to the zone of actual development. While the results of static assessment show us the current abilities and performance of the student, the analysis of ZPD allows us to evaluate the emergent ability of the student who learns from the interaction with peers and others. This emergent learning ability may serve as a better predictor of the students' educational needs than results obtained from static tests. E-learning environments can sustain such approaches.

Other researchers have described a whole raft of possible interactive interventions and tasks to be used during assessment, such as asking leading questions, modeling, presenting problem solving tasks, and developing inquiry based learning approaches. Using this construct of dynamic assessment, a number of examples are provided of actual assessment tasks currently used in e-learning environments, where students can demonstrate emergent skills in problem solving, collaboration, inquiry and critical thinking. Table 1 presents examples of online tasks and forms of assessment.

Table 1: Examples of online assessment tasks

Authors	Skills assessed /knowledge domain	Approach	Example of assessment task
Nicholls & Philip, R. (2001).	Drama	Threaded bulletin board, collaboration	Students post a theatre review online, and read, reflect respond and build two new threads
McLoughlin & Luca, (2006)	Project management	Online, Authentic task, team based	Students create contracts, management models, plan roles and design a website to meet client needs. Peer assessment online
Fitzsimmons (2006)	North American fiction and film	Use of online journal	Students write a critical review of a book and post in online; act as members of an editorial board
Anderson (2005)	Archives and records management	Online discussion	Students posted responses to problems, commented on others discussions, and engaged in discussions
Lee, Chan & Van Aalst, (2006)	Computing	Collaborative problem solving and e-portfolios	Guided by several knowledge-building principles, they were asked to identify clusters of computer notes that indicated knowledge-building episodes in the computer discourse, and compile these into a portfolio

Conclusions

These examples of how social software tools can be used to assess student learning indicate that a range of strategies can be employed to ensure that students develop process skills, knowledge and generic competencies that enable them to demonstrate learning outcomes. While ICT does not automatically add quality or guarantee better learning outcomes, social software tools driven by learner-centred pedagogy, may facilitate and support processes of collaboration, engagement and reflection and create spaces for multiple perspectives, dialogue and social connectivity. Online assessment design processes, if managed within a sound pedagogical framework, can support rich opportunities for innovative and engaging forms of learning, and thereby meet the needs of a diverse learning population.

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Online student contracts to promote metacognitive development

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Knowing about one's own cognitive ability, and how best to use this ability in understanding new educational content, solving problems and making effective decisions is one of the holy grails of education! Metacognition is widely perceived as being integral to effective learning and much literature and research has been devoted to this area. However online learning environments that effectively support the development of students' metacognition are rare and difficult to develop. This paper describes one component (the student contract) of an online learning environment designed to support the development of metacognition through a cycle of planning, monitoring and evaluation. Students firstly complete a self assessment questionnaire that helps expose their preferences and orientations; this forms the basis of the student contract. The design and logic of the student contract is outlined, with an overview of the complete strategy being used to help promote metacogniton.

Keywords: metacognition, negotiated assessment, teamwork

Introduction

> Adam is a multimedia student who is working for the first time on a major project with other students. The project involved the creation of a DVD video to promote a local business. "Great!" thinks Adam. He's always liked movies and enjoys design. As the project progresses, though, he starts to realise that maybe he made the wrong choice.
>
> All the other members of his team are relying on him to do his share of the work. The problem is, when Adam started out, he promised he'd have some video ready to show the client in the first few weeks. He just didn't realise how long it would take! Now his project manager is angry at him for not submitting the work on time, the client is starting to get jittery and Adam has just been told that he also has to do the packaging for the DVD for distribution too. After all, when he signed up for the role he told the other members of the team that he enjoyed graphic design. It's now only a few weeks before the date of delivery and what seemed like a fun and trivial assignment has become a major ordeal. If this is what it's like to work in project teams how is Adam going to be able to work in industry?!

Most people have experienced the feeling of disorientation when working in new areas or tackling processes that are unfamiliar. Developing an understanding of how to learn in different situations is supported through activities such as planning how to approach the task, monitoring success or comprehension in the different phases, and then finally evaluating the success. In the example above, no planning is evident to cater for the situation, and though ongoing monitoring and evaluation are evident, this is only with the final realisation of failure.

Metacognition is often seen as something students have rather than something that can be taught. However, rather than being developmentally fixed, research is showing that the development of metacognition may be subject to instructional intervention (Boekaerts, 1997). The question then becomes one of how to promote it? Weinstein & Mayer (1986) see all metacognitive activities as partly the monitoring of comprehension, and it would appear that this ability to monitor oneself is what distinguishes metacognitive activity from domain specific cognition. Wilson (1999) defines metacognition as an "awareness individuals have of their thinking and their evaluation and regulation of their thinking".

Blakey and Spence (1990) cite Dirkes' synthesis of much of the literature on metacognition into the following features:

- connecting new information to former knowledge
- selecting thinking strategies deliberately
- planning, monitoring, and evaluating thinking processes (Dirkes, 1985).

Each of these three points defines some aspect of monitoring and control. *Connecting* new information with former knowledge is primarily driven by the context of learning, and within a framework of skills inherent in a specific task. Thus it is integral to domain-specific skills. *Selecting thinking strategies* involves the actual development of metacognitive strategies applied to a task. *Planning, monitoring, and evaluating* however, define the internal processing used to support the acquisition of domain specific skills and inform the application of regulatory strategies. These can therefore be considered key to the whole process of metacognition as they cross domains of learning and go beyond the pure application of strategies.

One of the ways of promoting metacognition is through assessment. Haefner (2004) describes an approach to assessment that engages planning, monitoring and evaluation through three different mechanisms of assessment feedback. These engage students in setting goals, evaluating their performance and monitoring their understandings through techniques that are: internal, such as self-assessment; parallel such as through peer collaboration; and external, such as tutor feedback.

This study builds on this approach by engaging these forms of feedback in a formative way, where the criteria for students judging the value of their work is negotiated over a semester. The study is based around a final year undergraduate unit in Project Management Methodology for Interactive Multimedia development. As with most final year courses (both graduate and undergraduate), teamwork is often needed to complete developmental projects that illustrate the students' technical/content skills learnt.

JAMTART – An EPSS to help promote metacognitive processing

Over the past year the researchers have been developing JAMTART, an Electronic Performance Support System (EPSS) designed to promote the development of students' metacognitive processing abilities. Design-based research has been used to inform its development, and the first module has now been designed, developed and evaluated (Luca & McMahon, 2006). Offline approaches have been used to design the modules, with student feedback gathered and analysed to help in designing the online tool (McMahon & Luca, 2005).

JAMTART uses open source software (to be made freely available), and developed with administration, tutor and student views. Educators will have the flexibility to set up assessment criteria through the use of a wizard to help contextualise the tool to any discipline. As shown in
Figure 1, the tool will contain the following modules:

1. *Self-assessment questionnaire* which provides students with feedback on their skills and attributes to help them make meaningful decisions regarding team roles and responsibilities.
2. *Team operational plan* which is based on the results of the self-assessment questionnaire, as well as students' career aspirations. The plan outlines operational guidelines the team follows as well as the negotiated performance criteria for each allocated macro task.
3. *Student Contract* which identifies the main (macro) responsibilities individual students have in the team. This ties into the unit's assessment criteria and allows students to clearly state what major roles and responsibilities they will take.
4. *Monitoring*. Each week, students enter their actual progress/performance (time, percent complete, quality and comments). This is compared to their estimated progress and performance as stated in the contract. This information is summarised and presented in graphical and tabular format to show how their roles and contributions within the team are evolving. This section concentrates on micro tasks that are related to macro tasks outlined in the student contract.
5. *Overall Evaluation & Reflection*. This portfolio tool shows summarised data such as comments, personal reflections and rationales for changes in estimations that evolved during the semester, and acts as a prompt for students to evaluate their overall performance. The emphasis here is for the students to explain *why* some tasks went off track, and why others were successful i.e. lessons learnt, skills that need enhancing and also areas of strength that can be carried forward in career options.

These map back to unit outcomes and indicate the level of achievement obtained against those outcomes (low, medium or high).

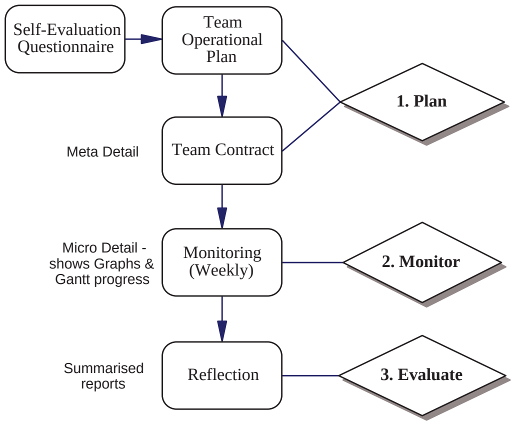

Figure 1: JAMTART – an online EPSS

Design and implementation

The main goal in developing this tool is to engage students in the processes of planning, monitoring and evaluation through peer review techniques. This was initially conducted through an offline learning approach, with a view to the construction of an online tool to facilitate the process. The basis for this approach is design-based research as advocated by the Design-Based Research Collective (2003). It acknowledges the context-laden nature of instructional settings, and the multiple variables inherent in these. Instead of controlling variables and using fixed procedures in social isolation, the aim is to characterise the situation, and allow flexible design revision and social interaction. Ultimately the researcher is a co-participant in design and analysis rather than an experimenter (Collins, 1999). This combination of both practical and theoretical components is underscored by Cobb et al. (2003) who identified five distinct features:

- a focus on developing a class of theories about the process of learning and the means that are designed to support it
- an interventionist approach, acting as a test bed for innovation
- building on the first two features, an aim of creating conditions for developing theories, but placing these theories in harm's way
- an iterative approach to design – the intended outcome being an explanatory framework that specifies expectations that become the focus of investigation during the next cycle of inquiry, and
- the theory generated must do real work – rather than developing a generic theory that may be difficult to put into practice, design experiments speak directly to the types of problems that practitioners address in the course of their work.

This focus on theory building through practical application and an iterative approach to development make this model a suitable one for a study such as this, which aims to explore metacognitive processing, but with the practical goal of developing a product that can lead to effective learning through negotiated assessment.

Context

The offline research that informed the development of JAMTART was with a group of final year students enrolled in the Interactive Multimedia course at Edith Cowan University (IMM3228 "Project Management Methods"). The unit is designed to encourage the development of a range of professional skills, as can be seen from the following learning outcomes:

1 Apply a range of project management and generic skills appropriate to the development of multimedia projects including time management, collaboration, communication, self-assessment, peer-assessment, task management, problem solving, information management and learning to learn skills.
2 Make a significant contribution to a team-based multimedia development project.

The learning environment requires students to form teams and develop web sites for clients that conform to industry requirements. Teamwork is carefully structured to allocate clear and concise responsibilities that support the development of important professional skills (Collis, 1997; Klemm & Snell, 1996; English & Yazdani, 1999). Students select their own projects, teams and tasks based on their skills and aspirations for future employment. Team based assessment is 50% of the overall mark, and included the development of a project proposal, design specification, metrics, evaluation report, post-mortem and a web site. Students are required to select:

- *Team role* – each team requires a project manager, graphic designer, programmer and instructional designer. Roles could also be shared, combined or created (e.g. media designer, content developer, evaluator and tester). These details are negotiated and finalised in the first two weeks of the semester.
- *Project topic* – selected by students to enhance their skills, though considered for suitability by tutors based on team roles, client, clearly achievable objectives value of final product.
- *Clients* – team members consider how to approach clients and establish what commitment and input they would give the project. The client is requested to pass comment on the quality of the final product.

A custom built online courseware management system (http://www.scam.ecu.edu.au/) is used to deliver the content in blended mode, and a final product is compiled on the university server (see http://studentprojects.scam.ecu.edu.au) as an on-line CV to help students promote themselves to potential employers. The web site contains the project name, description, team members, their roles, web site URL, and documentation (project proposal, design specifications, metrics, evaluation and post-mortem).

The learning environment promotes an authentic context that provides tangible benefits for the students. Not only do students end up with a CV item they can show potential employers, but also the design of the unit provides an opportunity for students to identify their strengths/interests and nurture them in a supportive environment.

Negotiated assessment

This unit has been designed over a number of years through gradual refinement of teaching and learning approaches based on design based research. The focus was to design a learning environment that integrated teamwork with negotiated assessment to help students and tutors make informed decisions about transferring marks between team members to promote equitable teamwork, as well as helping students understand the value of their own and others contributions.

The educational design focus is on learning activities that are authentic, self-regulated and reflective (Luca & Oliver, 2003). Project work is integral to the unit and students liaise with real clients to scope, design, develop, evaluate, cost, schedule and track projects, reporting on discrepancies and developing documentation that has direct relevance in the industry. The final product and documentation is hosted on a university server for students to use as an electronic CV to enhance employment opportunities. This authentic context provides motivational value in which students are encouraged to take ownership for their own learning by selecting their project topic, team members and desired team roles to match their aspirations for employment.

Students complete a *Self-Assessment Questionnaire* designed to help them gain understanding of their team skills i.e. administrator, analyst, negotiator, verbal communicator, written communicator, listener, motivator or decision-maker. This helps determine their skill deficiencies and strengths when working in a team. Once this is complete, they then develop a *Team Operational Plan*, where they outline the operating rules of the team, including individual goals, team goals, meeting strategies, task assignment issues and communication, a decision-making process and conflict resolution strategies. The final stage in the process is the *Student Contract*, which outlines the main (macro) responsibilities individual students have in the team. This is tied into the unit's assessment criteria and allows students to clearly state major roles and responsibilities (Table 1).

Students use the team contract to negotiate their assessment items and continually review these for each assignment, by reflecting on how successful they and peers have been in completing the tasks outlined in the contract. Each row in the Team Contract represents a key assessment point and students can consider the extent of their contribution based on their aims for future employment and current skill sets. With four students in each team, each student's contribution should constitute 25% of the overall mark. However, this is not mandatory, and students can specify how much of the "assessment pie" they want. This negotiation of assessment is conducted in two stages. Students consider:

- Estimated Contributions – at the beginning of the semester students commit to completing a series of tasks by specifying their tasks
- Actual Contributions – when each of the team assignments are submitted, the Team Contract is re-submitted. Students then complete their "Actual Contributions", with a review of the mark they actually contributed. The team and tutor all agree to the reviewed mark, and this information is used to re-distribute marks to help promote fair and equitable teamwork.

Table 1: Team contract

Assessment Items	**%**	**Name 1**				**Name 2 etc..**			
		EM	EQ	AM	AQ	EM	EQ	AM	AQ
Online Tasks	16								
Project Proposal	10								
Design Specifications	5								
PM Doc 1	2								
Application Development	5								
Presentation & Online CV	2								
Evaluation Report	3								
Metrics Report	3								
Post Mortem	2								
PM Doc 2	2								
Total	50								
Signatures									

Note. EM = Estimated Mark, EQ = Estimated Quality, AM = Actual Mark, AQ = Actual Quality.

It is anticipated that having students negotiate each assessment item promotes responsibility within the team, as well as define the quality expected from each team member. So when the actual assignments are submitted, it is clear how much effort/quality each team member has contributed. Also, the fact that the assignment components are authentic, and aligned with good practice, helps motivate students contribute to this process.

Beyond the issues of fairness and equity, this negotiation also involves students in planning their learning, by setting goals and estimating their performance both in terms of outcome (mark) and process (quality of work). They are required to evaluate these goals against actual achievement when the assignment is submitted. Through this cyclical process and through the internal, parallel and external feedback mechanisms of peer, tutor, and self-assessment, students are engaged in a continuous process of self-monitoring.

The implementation of the team contract is based on planning, monitoring and evaluation (Dirkes, 1985). By week three students plan and negotiate assessment items they are responsible as well as predict the quality of these. As the semester progresses, students continually monitor their own performance in terms of their stated plans as well as their team members' commitments. If they felt the team is not progressing as agreed, they have team meeting or inform the tutor. As well as ongoing modification of their initial plans, students formally evaluate their performance and that of their peers when the assessment item is submitted.

It is on this basis that the design of the student contract was formulated for the online tool (JAMTART).

Design of an on-line component to support reflective practice in the negotiation of student contracts

The student contract module of JAMTART reflects the process that has previously been conducted offline and builds on the existing self assessment module where the feedback provided through self assessment can be used to select roles in multimedia product development and monitor their performance in those roles during the development lifecycle. Unlike the self assessment module, administration of the student contract module is conducted primarily by students themselves. The three components that are integral to the module are:

- set up contract
- monitor contract
- project overview.

Such components adhere to the metacognitive focus on planning, monitoring and evaluation, although as can be seen through the following design, self-monitoring underpins the majority of learner activity as they engage in monitoring their performance throughout the duration of the project.

Setting up the contract

This component of the student contract module is the one that has the most input from the teacher. The teacher's role in setting up the contract is to:

- set up projects for students to subscribe to
- define a target level of performance for the project in terms of overall hours
- define the monitoring period for each stage of the project, i.e. the frequency that students are required to evaluate their performance and modify their commitment to various jobs within the project
- set global parameters for the monitoring component such as whether students have the option of making their comments public or private
- sign off on each student's commitment to the project.

For the teacher, this sets some important foundations for the project. For example, the decision to provide the option for private or public comments has important implications for the value of the environment to promote metacognition. The management of the project requires openness and accountability between students and this is an argument for public comments. However, should there be issues within a team then the validity of these comments could be compromised by making them public, in which case the option to make comments private is a useful one, and can provide a useful supplement to the private self-evaluations in the Evaluation module of JAMTART.

Having the teacher set a nominal overall number of hours provides a basis for students to commit to jobs. It ensures that students are thinking strategically in terms of allocating their time and provides a basis for assessment. The percentage of hours that they distribute between jobs can be used to provide assessment weightings for those jobs.

This is best shown from the students' perspective when they come to assign themselves to jobs. The Set up contract component enables students to:

- Define a role for themselves within the team. This is informed by the initial Self-Assessment Module of JAMTART and will be different for each individual depending on the nature of the project and the number of team members.
- Define jobs that are relevant to their role, and proportion hours for each job based upon the nominal hours allocated by the teacher.
- Assign themselves to other existing jobs where those jobs are to be shared.

These parameters then carry over to the monitoring component.

Monitoring the contract

Figure 2 demonstrates the interface of the main monitoring component of the student contract module in storyboard form. As can be seen, the module adopts a structure similar to a GANNT chart where students and teachers can get a summarised visual overview of the jobs, their duration and the students assigned to them. From this screen students can add a job to their role, delete a job, or select an existing job to contribute to it. They can also see the jobs other members of the team have allocated for themselves and the extent to which these jobs have been completed.

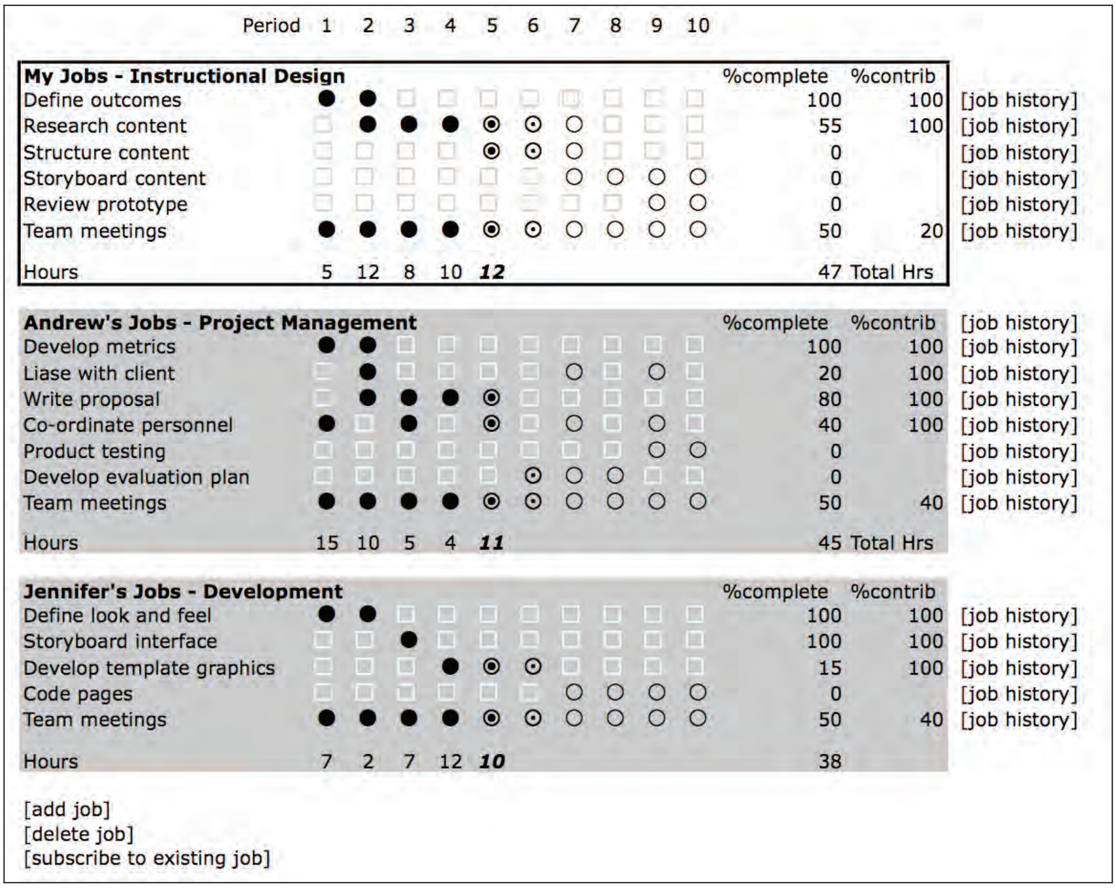

Figure 2: Student contract view

For each period, the status of the job is shown. These are:

- Inactive, represented as a □
- Active for a previous period: ●
- Under review for the current period: ◉
- Estimated for the next period: ⊙
- Allocated for future period: ○

Clicking on one of the above icons brings up a 'Job Card' for that period (Figure 3).

In the Job Card view, a student is able to provide estimated hours that will be spent on the job as well as the actual hours and estimated percent complete. Feedback will also be provided in the form of the amount of hours that have been spent on a job to date, the previous estimated percent completion and the percent contribution that that student has made to the job. These statistics provide a finer level of granularity than is available purely from the contract view.

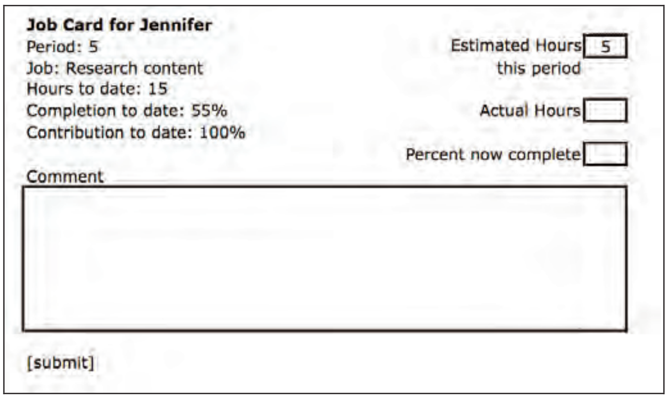

Figure 3: Job card view for a specific job and period

Most importantly, there is also room for comments. In this section, the student is required to comment on the work that was completed during that period, giving reasons for why a job took longer or shorter than was expected or issues that cropped up that prevented the student from allocating the amount of hours to the job that was initially estimated. It is these comments that form the basis of students self-monitoring. The self-evaluation, and reconfiguration of plans forms the processing inherent in students developing metacognitive approaches to their work and provides an audit trail for negotiated assessment.

All of the information contained in the job cards contributes to the summative information provided within the student contract (Figure 2). The hours underneath each period provide an overall aggregation of the hours the student has spent on the project. For individual jobs, clicking on 'job history' presents the hours spent on an individual job during the duration of the project as well as the comments and specific period data from the job card. The job history also has the advantage of including data provided by all the students who have contributed to a job. In many cases it is expected that other students will take over some of the responsibility for a job when one team member is too busy to do it all. At the same time, there are jobs which are shared by several members of the team. An example of this is team meetings. All members participate and the time spent on these activities needs to be identified and accommodated within the system (it also traps for issues such as team members who do not attend the meetings!). The percentage contribution presented in the Student Contract view provides a summary of this aspect of job completion.

Project overview

The final component of the student contract module is a project overview. This provides a view of the data for the student contract in a form that can help team decision processes during the project development. The information contained within the project overview is highly summarised and organised around the project itself rather than students' individual roles. The aim is to display the overall status of the project and to provide a means for the project manager in conjunction with the rest of the team to reallocated jobs within roles and report back to their tutors and clients. This is particularly useful when jobs are shared within a team and an overview is required of the job itself rather than individual member contributions. This global information, while less relevant to individual decision processes, provides some of the facility of a project management tool, eliminating the need for data to be duplicated between JAMTART and applications such as MS Project. It also supports the social negotiation of jobs within the team and could form an initial basis from which students then review and adjust their contract in the Monitor Contract component.

Implications and future developments

The proposal within this paper describes the basis of design-based research into a tool to allow students to monitor their performance within project teams. The goal is to support students' metacognitive development through the processes of planning, monitoring, and evaluating their thinking. This forms the main component of a broader suite of tools that will begin with self-assessment and lead to the final self-evaluation through the reflection on a final portfolio that provides an audit trail for all activity within the project.

As design-based research, the student monitoring module of JAMTART will provide a refined instantiation of a model for negotiated assessment that has worked in an offline manner successfully for students learning project management. It is expected that the tool will be implemented in 2007 and subject to further research.

Most lecturers have met an 'Adam' in their class, and arguably most practitioners can still remember feeling the same disorientation that Adam felt when having to contend with new scenarios that not only require them to apply learned skills but use their understanding of themselves and the task to develop new strategies. Adam will not be made 'metacognitive' within one semester, but by engaging him in the subordinate processes of planning, monitoring and evaluating his performance, the awareness developed through his use of JAMTART will better equip him when faced with new problems and scenarios which require him to use his understanding of himself and his own thinking processes to develop his own strategies for success.

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The 'copy and paste' function: A flawed cognitive tool in need of redesign

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This paper argues that the traditional version of the 'copy and paste' function used in many computer-mediated learning environments is a flawed cognitive tool for learning applications and may in fact subvert the constructivist philosophy of many learning packages. An initial study was conducted, using distributed cognition theory to redesign the interface of the 'copy and paste' function, to examine the efficacy of embedding a specific interaction strategy (reported in Morgan et al., 2006a, 2006b). The embedded interaction strategy involved summarisation note taking tasks and the results of this empirical study are outlined in order to establish the efficacy of this approach. This paper goes on to argue that this principle can be extended to include a wider variety of interaction strategies designed to invoke different encoding techniques (Lutz, 2000), including note taking, categorisation and concept mapping. By embedding different interaction strategies into the interface of the 'copy and paste' function an effective processing strategy emerges as a consequence of employing the tool. In addition the learner is exposed to a range of processing strategies and may become conscious of choosing the appropriate interaction strategy for the specific task at hand, thereby improving their metacognitive skills. A series of further studies are advocated to examine the effects of the approach that has been outlined.

Keywords: distribute cognition, mediating artefacts, cognitive tools, constructivism

Background

The constructivist multimedia package *Exploring the Nardoo* (Interactive Multimedia Learning Laboratory, 1996), which explores water management, quality and environmental issues, was the original context of an initial study of the 'copy and paste' function (reported in Morgan et al., 2006a, 2006b). *Exploring the Nardoo* (Cordorey et al., 1998; Harper et al., 2000), is organised around a number of investigation projects and simulations, focusing on water quality and usage, and employs a virtual information landscape of an inland river system in which a variety of resources, including audio, video, graphics, texts and simulations, are embedded. In this initial study concerns were raised that the traditional form of the 'copy and paste' function subverted the constructivist philosophy of the package. Extensive text-based resources are embedded in the *Exploring the Nardoo* package and the learner is provided with a range of tools, a PDA (Personal Digital Assistant) Notes Module, a TextTablet, genre templates and note taking resources, to assist them in processing this content. Previous studies of the *Exploring the Nardoo* package have indicated that some learners found it difficult to synthesize a response from the abundance of information available while others had problems editing out redundant material in order to produce concise responses targeted at the investigation topic. For example:

> ... one teacher believed that the students collected all the relevant resources but felt that, when it came down to putting it together and making all that abundance of information something more concise, the students had difficulty. She explained that even though she reminded her class "don't just copy slabs of information and regurgitate it in your report, make sure you read it, understand it, relate it to the question", based on the students reports presented, she felt that she could have reinforced this concept of analyzing the information more (Hedberg et al., 1998, p. 3).

The authors have argued (Morgan et al., 2006a) that the doubts raised by teachers are directly related to the functionality of the Notes Module of the package with its traditional 'copy and paste' function in that this tool does not seem to complement the constructivist principles of the learning environment. In its traditional form the ‘copy and paste’ function allows learners to import text into a document in a form that may be formatted in a way that is not visually distinguishable from their own work and that does not necessarily include pointers to its original context and/or authorship.

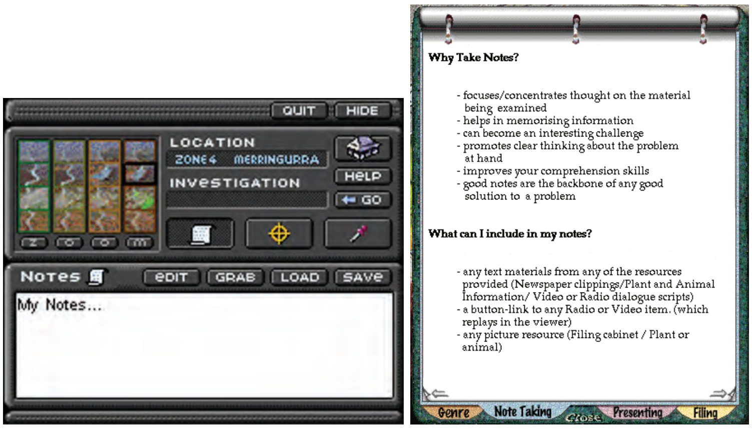


Figure 1: Exploring the Nardoo: Notes module and note taking advice

The ‘copy and paste’ function can be seen as an example of a cognitive tool (Jonassen, 1996; Jonassen & Reeves, 1996; Lajoie, 2000; Lajoie & Derry, 1993) which can be used as a ‘knowledge construction implement’ that assists learners to reflect on meanings and articulate their understandings. The cognitive tools approach uses commonly available software tools to:

- empower learners to design their own representations of knowledge rather than absorbing knowledge representations preconceived by others.
- support the deep reflective thinking that is necessary for meaningful learning (Jonassen & Reeves 1996, p. 698).

However, the development of the ‘copy and paste’ function in a business context has led to an arrangement of affordances and constraints which increase the speed and accuracy of information reproduction. These affordances and constraints may be problematic when this tool is applied to a learning task.

> Activity Theory (Engeström, 1998; Nardi, 1996a), proposes that artefacts carry with them, in their form and function, the history of their development and use. In other words, encoded within their form are specific ways of acting and thinking, which influence those who make use of these tools. Generic tools may be inappropriate for some learning tasks or in some cases could be easily modified to produce more effective learning outcomes (Morgan et al., 2006a).

In this interaction little guidance or support is provided to the learner on effective methods of using appropriated content and the affordances and constraints of the traditional ‘copy and paste’ function may in fact subvert the constructivist learning objectives of the interaction.

Distributed cognition theory

Vygotsky (1980), has argued that the cognitive processes of humans are to a large extent enabled and shaped by artefacts from the cultural context. This concept differentiates distributed cognition (Cole & Engeström, 1993; Cole & Wertsch, 1998; Dillenbourg, 1996; Engeström, 1999; Hutchins, 1995; Hollan, Hutchins & Kirsch, 2000; Karasavvidis, 2002; Nardi, 1996a, 1996b; Pea, 1985, 1993; Perkins, 1993; Salomon, 1993; Wertsch, 1985) from other theories of cognition such as information processing theory (Atkinson & Shiffrin, 1971; Lutz, 2000; Miller, 1956; Sweller, 1999). Information processing theory is generally concerned with the means by which stimulus is processed internally by the individual. The significant events in the cognitive process are seen to be internal to the individual and therefore, the outcomes of cognitive activities are determined primarily by the internal resources of the individual.

In contrast, distributed cognition theory conceptualises the mind as a node embedded in a mesh of social and cultural relationships.

> Minds are not passive representational engines, whose primary function is to create internal models of the external world. The relations between internal processes and external ones are far more complex, involving coordination at many different time scales between internal resources—memory, attention, executive function—and external resources—the objects, artifacts, and at-hand materials constantly surrounding us (Hollan et al., 2000, p. 177).

A valid outcome of cognition in terms of distributed cognition theory may involve the successful utilisation of resources in the environment, or the adaptation of a mediating artefact to a new context or purpose, or even the fixing of a successful pattern of cognition or activity into a new mediating artefact.

> … because what we call mind works through artifacts it cannot be unconditionally bounded by the head nor even by the body, but must be seen as distributed in the artifacts which are woven together and which weave together individual human actions in concert with and as a part of the permeable, changing, events of life (Cole & Wertsch, 1998, p. 3).

The arena for examining issues of cognition is therefore changed from the concept of the mind in isolation, planning actions and evaluating experiences, to the mind situated and enmeshed in a context.

Interaction strategies provide a good example of the fact that the resources that shape and enable cognitive processes are not limited to internal cognitive resources and may be derived from a variety of sources. Vygotsky (1980), with his concept of the Zone of Proximal Development, has already pointed out the important role of parents in structuring and enabling the cognitive activities of children through a process of assisted dialogue which is later represented in the adult primarily as internal resources for thinking. Wright et al. (2000), point out that all activities require a range of 'resources for action'. These resources not only influence the nature of the activity but also the nature of the cognitions that occur during that activity. Interaction strategies, structures that control action, are probably the most important category of the 'resources for action' discussed by Wright et al. (2000) but they are only one example of the resources for cognition that may be distributed between the internal and external components of the system.

In terms of distributed cognition theory the actual source of the interaction strategy, whether internal or external, is not as important as its access characteristics. Access characteristics, or the cost of access, may be assessed from a variety of perspectives. These include the reliability of access, the ease with which it is employed, and the cost in internal cognitive resources of accessing and using the resource. All internal and external resources will have a variety of costs and benefits. The question is which method is most effective in learning contexts? In particular when using the 'copy and paste' function which method will be most effective in assisting the learner to process content effectively for understanding between:

1. Relying on the learner to remember and implement a processing strategy which they have already 'learned'
2. Relying on an instructor to tell them which processing strategy to use,
3. Representing the processing strategy in the environment in the form of a plan which the learner then follows, such as a worksheet, set of instructions or task list,
4. Embedding the processing strategy in the interface of a tool so that its affordances and constraints guide the learner when it is used to work with the content.

In addition could inappropriate processing strategies that are already embedded into a tool have a large effect in undermining the effectiveness of the first three sources of processing strategies in learning environments?

These questions were investigated in an initial study of the ‘copy and paste’ function. The results seem to indicate that embedding an interaction strategy into the interface of a tool may be more effective than resources represented in the environment in the form of a plan for action or relying on internal resources to remember and implement the appropriate interaction strategy. In addition inappropriate strategies that have unintentionally been embedded in the interface due to the historical development or context of the tools creation may work to subvert more effective interaction strategies that are represented in the environment as a plan or that are supplied by others or that have been learned. An example of this is seen in the ‘copy and paste’ function where its original context of development in business applications has led to a set of affordances and constraints being built into the tool which may not be appropriate for learning activities. The traditional form of the ‘copy and paste’ function may be undermining attempts from various sources to implement more effective interaction strategies.

The redesigned ‘copy and paste’ function

The aim of the initial study in redesigning the ‘copy and paste’ function of notepad tools, such as those found in the *Exploring the Nardoo* package, was to change the order and manner in which the learners carry out learning activities so that they can be supported in their attempts to form an effective distribution of cognitive activities when using this tool.

A careful examination of the ‘copy and paste’ function has led the researchers to the conclusion that the constructivist theoretical base on which the package is built is undermined by the provision of a notepad tool that:

1. Makes it easy to appropriate the information ‘as is’.
2. Separates the processes of exploring the information landscape and gathering resources, and the process of making a response to those resources via a project, report or presentation.
3. Does not make explicit the difference between the learner’s original work and the resources gathered from the environment (Morgan et al., 2006a).

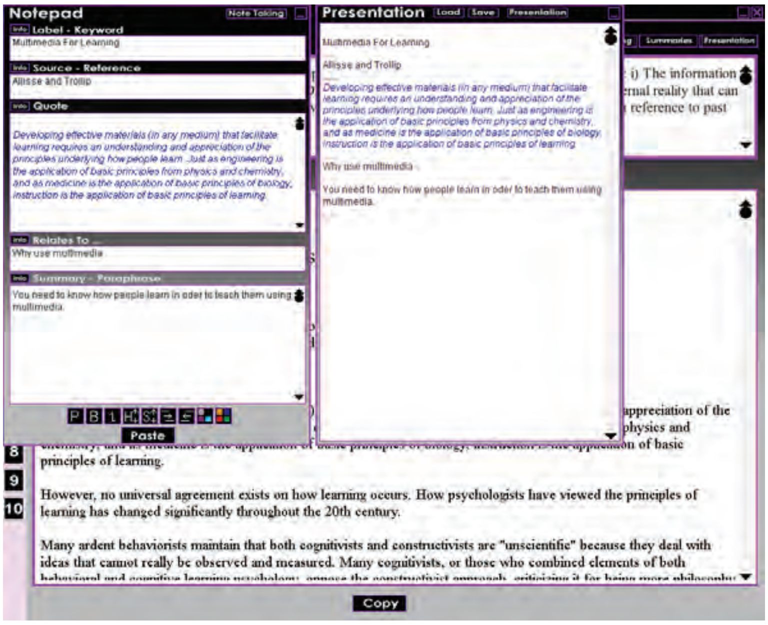


Figure 2: The modified version of the ‘copy and paste’ function

Figure 2 shows the interface of the redesigned ‘copy and paste’ function used in the initial study in the form of a pop-up dialogue box, which consisted of five components: assigning a label or, noting of the source of content or a reference, differentiating quoted material through formatting of the text block, relating the material to a question or concept, and finally creating a summary or paraphrase.

The experimental study was conducted in 2005 and repeated in 2006 over a three-week period at Monash University involving participants from the second year of the Bachelor of Multimedia Systems program, with participants randomly assigned to Experimental or Control Groups. The control treatment involved the processing of content using a notepad tool with the traditional form of the 'copy and paste' function while the form of the notepad tool used in the experimental treatment is depicted in Figure 2. Data collection involved video taped observations of onscreen activity, pre and post treatment surveys and the collection of participant generated notes. In order to analyse the participants onscreen activity various observed activities were equated with the level of cognitive activity required to enact them, as reported in Morgan et al. (2006b). For example creating a keyword, summary or writing independently were equated with a high level of cognitive processing of the content while activities such as browsing content were equated with a low level of cognitive processing of the content. The relative durations of activities categorised as high, medium or low were then compared between Experimental and Control Groups. In a similar way the features of texts notes produced by the participants were also categorised as being indicative of high, medium or low levels of processing, with original content being assessed as indicative of a high level of processing and unmodified copied material indicative of low levels of cognitive processing. In this case the relative volumes of text categorised as being indicative of high, medium or low processing of the content were then compared between the two groups.

The effectiveness of the experimental treatment in promoting high levels of learner processing of content has been reported in Morgan et al. (2006b). To summarise these results, differences were observed between the Experimental and Control Groups in terms of changes to interaction strategies employed by learners and changes to the features of the text produced by learners, with learners using the modified version of the 'copy and paste' function displaying higher levels of cognitive processing when interacting with the content than the Control Group.

After approximately 13 hours and 43 minutes of video taped observations were analysed, significant differences were detected in the nature and duration of participant's onscreen activity between the Experimental and Control Groups. The most significant finding was that on average the Experimental Group spent 27.65 % of their time engaged in activities that indicated a high level of cognitive processing which was a much higher percentage than the Control Group. For the Experimental Group 5.11% of their time was spent in activities that were characterised as requiring medium levels of cognitive processing of the content such as referencing. The remaining 67.25% of their time was spent in activities that required a relatively low level of cognitive processing of the content such as browsing. The Experimental Group also tended to display a greater range of activities, and also a willingness to switch between activities requiring differing levels of cognitive processing such as browsing and copying to labelling, writing and summarisation activities. It was an important finding of the study that the Control Group spent much less time engaged in activities that indicated a high level of cognitive processing and in fact only devoted 6.67% of their time on average to such activities. This pattern of low levels of engagement with the content was widespread and persistent in the Control Group who used the unmodified version of the 'copy and paste' function and tended to confirm that there was a major problem with the affordances and constraints of this tool. Only 1.63% of their time was spent in activities requiring medium levels of cognitive processing. The majority of their time, 91.70 %, was devoted to activities that required relatively low levels of cognitive processing, such as uninterrupted browsing. The Control Group tended to pursue low level processing strategies such as browsing for extended periods and rarely interrupted the browsing activity to process the content further in order to consolidate their learning by using other forms of activity that required higher levels of cognitive processing.

Statistical analysis indicated a number of significant effects were observed between the Experimental and Control Groups. Table 1 summarises the *t*-test results when comparing the average percentage of time that participants were observed to spend in activities characterised as requiring either high or medium or low levels of cognitive processing.

Table 1: Level of cognitive processing indicated by the average percentage of time spent in activities

Average percentage of time in activities indicative of the level of cognitive processing	Experimental $n = 31$	Control $n = 28$	*t*-test	*df*	Probability	Significant
High	27.65	6.67	4.7462538	57	$p < 0.001$	Yes
Medium	5.11	1.63	0.8004707	57	$p > 0.20$	No
Low	67.25	91.70	2.3860236	57	$p < 0.05$	Yes

Finally following the analysis of approximately 490 pages of notes significant differences were observed in the features of the texts produced. The texts produced by the Experimental Group over three one hour sessions contained an averaged volume of 66.79 words that indicated a high level of cognitive processing, such as writing, labels and summaries. However the Control Group averaged only 21.88 words indicative of high level processing of the content. The average volume of text that indicated moderate levels of processing, such as references, was approximately the same for both groups. The Control Group produced a larger volume of text indicating low levels of processing (777.04 words), such as unmodified copied material, than the Experimental Group (596.52 words), therefore the Control Group relied more on mechanically copying text without modification.

Table 2 summarises the *t*-test results when comparing the average volume of text features that were detected in the participants' notes and that were characterised as requiring either high or medium or low levels of cognitive processing.

Table 2: Level of cognitive processing indicated by the average volume of text features

Average volume of text features indicative of the level of cognitive processing	Experimental n=61	Control n=66	*t*-test	*df*	Probability	Significant
High	66.79	21.88	3.5089881	127	$p < 0.001$	Yes
Medium	16.36	16.13	0.4770723	127	$p > 0.20$	No
Low	596.52	777.04	2.6734777	127	$p < 0.01$	Yes

The results obtained in this initial study of the 'copy and paste' function indicated that the experimental treatment had a significant impact on the activities and output of the learners. However the embedded interaction strategy that was used may not be appropriate for all learning contexts. A range of interaction strategies may be designed in order to target different encoding strategies and in order to suit specific learning tasks.

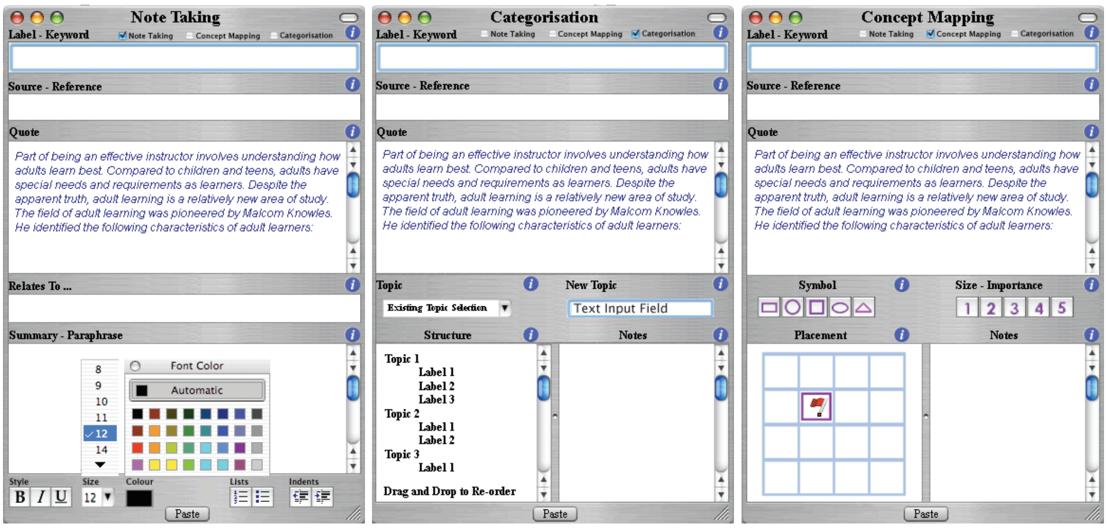
Alternate interaction strategies for the 'copy and paste' function

The study reported here presents the implementation of one possible interaction strategy that has been embedded into the interface in one particular form. The aim of embedding the interaction strategy in the interface is to ensure that there is at least one effective interaction strategy available to all learners even if they do not possess the internal resources to implement such a strategy on their own. Alternatively the support provided by the embedded interactive strategy may allow the learner to devote more cognitive resources to processing the content for understanding. However a single interaction strategy may not be appropriate for all contexts and for all learning styles. The creation of a range of interaction strategies may benefit a wider range of learners in a wider range of contexts. If the nature of these interaction strategies were made explicit the true power of this approach may be seen when the learner can make a choice of the most appropriate interaction strategy for their particular task. The interaction strategies that will be considered include the following:

- An update of the 'note taking' strategy
- A 'categorisation' strategy
- A 'concept mapping' strategy

Redesigning interaction strategies

What would the note taking strategies then look like in this context? The following designs are now being developed to test their efficacy in developing greater user interaction with resources being used for explorations of ideas within resource rich environments such as *Exploring the Nardoo*.



a) *b)* *c)*

Figure 3: Interaction strategies: a) Update note taking, b) Categorisation, c) Concept mapping

Updated note taking strategy

The Note Taking strategy design depicted in Figure 3 a) has been drawn from the version used in the study reported here. The interface has been designed using the Apple interface guidelines in order to improve the design of the formatting tools in particular. The user will also have the option to change the interaction strategy selected. It is anticipated that the note taking strategy would be the default strategy for the application. The user would also be able to turn off all processing strategies and revert to the traditional form of the 'copy and paste' function via a menu option.

Categorisation

Interacting with content by 'categorising' concepts is another way to process content for understanding because it requires the learner to examine relationships and the underlying organisational structure of information. The interaction strategy of 'categorisation' could involve developing several major themes or topics and organising content within these groups. This helps emphasize the relationships between content but may also assist the learner to structure the information and their notes around several major concepts. These categories can equate to the major concepts or paragraphs used in the text. In order to implement this strategy the learner must be assisted to form a number of categories which may involve developing a detailed description of the nature of each category. The learner must also be able to assign a piece of content to a category that they have developed. The learner can also record some additional notes related to the content. When the information is pasted into the learner's notes the content should be placed into the appropriate group of content. Figure 3 b) is a screen design for the embedding of this interaction strategy into the interface.

In this strategy the learner would still need to label the content and record its source. In the 'category' area the learner could enter a new category or select an existing category from the drop down menu. In the 'structure' area the structure of categories and labels is represented. Ideally the learner should be able to drag these about to manipulate the structure of the document at an outline level. This may also represent a 'ranking' or 'ordering' strategy and would prompt the learner to consider relationships and structure. In this case the structure would establish the order of importance of concepts.

Concept mapping

An alternate interaction strategy that could be implemented in the revised 'copy and paste' function is a 'concept mapping' strategy. This strategy represents a very effective way of encouraging learners to process content for understanding. The output of the learner using a concept mapping technique is significantly different from the raw content and reflects not only an examination of concepts but also an examination of relationships. The concept mapping technique engenders extensive processing of the content.

> Constructing computer-based semantic nets engages learners in (1) the reorganization of knowledge through the explicit description of concepts and their interrelationships; (2) deep processing of knowledge, which promotes better remembering, retrieval, and the ability to apply knowledge in new situations; (3) relating new concepts to existing concepts and ideas which improves understanding […] and (4) spatial learning through the spatial representation of concepts within an area of study (Fisher, Faletti, Paternson, Lipson, Thornton & Spring, 1990; Jonassen & Reeves, 1996, p. 707)

The interface layout required to implement a concept mapping interaction strategy could be configured in a number of ways. The interface design shown in Figure 3 c) indicates one method. In this case the learner must provide a label for the concept and also record the reference information for the source of the content. The learner must select a symbol in which the label will be placed and nominate a size for the symbol that will denote its relative importance. In the final section of the interface the learner can nominate a sector in the concept map in which the symbol will be placed and can record some additional notes related to the concept. After the learner has completed these tasks the information can be entered into a concept map using the 'Paste' button. Fine tuning of the position of the symbol and links to related concepts can then be completed on a full sized version of the concept map that would be displayed in the notes window.

Interaction strategy selection

This proposed design involves the concept of embedding a range of interaction strategies into the interface of the 'copy and paste' function. Many learners may be unaware that a variety of interaction strategies are available to process content, to take notes and to produce texts. Some may tend to rely on a single strategy due to the fact that a variety of interaction strategies have not been modelled for them. Modelling a variety of interaction strategies may encourage learners to be flexible and to enable them to deal effectively with a variety of learning situations. Asking the learner to select an interaction strategy may make learners more attentive to the interaction strategy that they are employing. This may enhance the development of metacognitive monitoring of the appropriateness of the selected interaction strategy and its results.

Figure 4: Selecting an interaction strategy

Conclusions

No single interaction strategy is appropriate for all tasks or all learners. Making available a range of interaction strategies may lead to positive learning outcomes in a wide range of learning interactions. Information on the types of interaction strategies available would be required in order to assist the learner to make a decision on the appropriate interaction strategy. From the discussions above it is clear that the interaction strategy embedded in the 'copy and paste' function in the initial study (reported in Morgan et al., 2006a, 2006b and with the major results summarised here) is only one of a variety of possible strategies. Each strategy could be appropriate for particular contexts and would encourage the learner to process content in a different manner. Implementing a variety of interaction strategies could allow learners to work in their preferred style while still providing guidance on effective interaction strategies. This can be contrasted with the current state for the 'copy and paste' function where little guidance or support is provided to the learner and where the affordances and constraints of the cognitive tool may in fact subvert the learning objectives of the interaction. A further series of studies are now being planned around these ideas to investigate the efficacy of these tools.

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Benchmarking e-Learning in UK higher education

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In early 2006 a new programme was launched aimed at benchmarking e-learning development across the UK higher education sector. The programme represents an early stage in the Higher Education Funding Council for England ten-year e-learning strategy, acknowledging the need to take stock of progress. This paper describes the background to the benchmarking programme, its approach, and some findings from the pilot.

Keywords: organisational change, ICT policy, benchmarking

Introduction

The UK-wide higher education benchmarking exercise began in January 2006. The background to the programme is contained in the Higher Education Funding Council for England (HEFCE) strategy for e-learning (HEFCE, 2005), published after a consultation process with the sector that took place in 2003. The consultation was characterised by the sector's reaction at that time to the high profile given to the UKeU (UK e-University) and many of the consultation responses seemed to be asking for a renewed focus on the e-learning provision on the sector's campuses. This is where the need for benchmarking the current state of play in the HEIs was first expressed. There was a strong feeling that the whole UK HE sector should pause, take stock, and rethink its approach to e-learning.

HEFCE delayed publishing its strategy until 2005, when all issues concerning the failure of the UKeU had been addressed. The strategy document is surprisingly reflective, and acknowledges openly the influence of the consultation on its main principle, the support of individual institutions in developing their own approach to e-learning. It acknowledged that the early concentration on infrastructure had now given way to a focus on pedagogy, and on connecting electronic communications with other processes, in a new blend of approaches to learning and teaching. HEFCE concedes that those best placed to shape a pedagogy-based, flexible delivery approach, with e-learning fully joined up with other processes, are the institutions themselves, and the Funding Council's role is to provide as much support as possible to help HEIs design and implement that development. This, then, provides the fundamental rationale for the benchmarking programme, and it is expressed clearly in the following extract from the strategy:

> The highest priority objective of our strategy is to enable institutions to meet the needs of learners and their own aspirations for development. We will achieve this by ensuring that our strategy is not prescriptive about the particular form or use that e-learning is put to in institutions, but supports institutions' own chosen e-learning missions. Linked to this, we will encourage and support institutions in setting their own e-learning goals, appropriate to their missions and state of embedding, and in measuring their own progress, by providing tools for benchmarking (HEFCE, 2005, p. 5).

A direct outcome of the implementation plan based on the strategy was to invite the Higher Education Academy (the Academy), in partnership with the Joint Information Systems Committee (JISC), to lead a UK-wide higher education e-learning benchmarking exercise.

The aims of the benchmarking exercise

The aims of the exercise are three-fold:

- to provide higher education institutions with the information to make informed plans for future larger scale institutional change and development
- to allow institutions to identify their current progress, on embedding e-learning, in relation to similar institutions

- to provide a picture of the sector as a whole in order to identify areas of strategic importance to inform the work of the JISC, the Academy and the Funding Councils, including the further development of the HEFCE e-learning strategy.

What is being benchmarked has been informed by the contexts and priorities of the participating institutions. The exercise has not been prescriptive about processes and tools, since the Pilot Phase of the initiative was designed to begin the process of clarifying institutional needs and setting boundaries. However, the benchmarks are providing both quantitative metrics and qualitative descriptors, with the latter providing an opportunity for the institutions to reflect upon and share their individual experiences.

Managing the benchmarking exercise

Following a call for expressions of interest in the initial phases of the benchmarking exercise in October 2005, nearly 60 expressions were received from across the sector. From these 12 HE institutions, one in partnership with a Further Education College, were selected to join the Pilot Phase in January 2006, with completion in July 2006. The institutions chosen to take part in the pilot were as representative of the diversity of the sector as was possible from those expressing interest. This resulted in a good spread of new and old, research and teaching intensive institutions and a good geographical mix, including representation from Scotland and Wales (the list of pilot institutions is given under approaches below).

The remainder of benchmarking exercise is then being phased as follows:

- in October 2006 around 40 institutions join Phase 1 of the exercise.
- from May 2007 Phase 2 will involve any other interested UK institutions.

A team of consultants were appointed by the Academy to work with institutions involved in the benchmarking pilot and provide support for further phases. The consultants helped to design, adapt and implement approaches and tools to meet specific institutional needs.

Approaches to benchmarking in the pilot

There was some early attraction to the idea that the greatest benefit for the sector would be gained by adopting a single benchmarking tool or method. One purpose of the benchmarking pilot is to provide the sector with the lessons from, and experiences of, several alternative approaches to benchmarking. These have been used to inform the decisions of the Phase 1 entrants to the benchmarking exercise. It was unlikely, however, that a single tool would be adopted across the programme since the institutions themselves have been encouraged to choose the method that is best matched to their profile and stage of development. In any case it is evident that benchmarking e-learning is a process that is itself rapidly developing with the nature of what is to be benchmarked.

It was agreed that the benchmarking exercise will be owned by the institution that undertakes it and was never conceived as a data gathering exercise on the part of the Funding Council, JISC, or the Academy. The whole exercise is developmental and should help to provide institutions with an opportunity to take stock, with the assistance of the Academy, of where they are in regard to e-learning, and should institutions desire it they can compare themselves to similar institutions.

During the Pilot Phase the institutions selected five differing approaches to benchmarking (Table 1). In the Pilot Phase the Academy wished to facilitate the flow and dissemination of information between participating institutions, between the Academy and institutions, and from all participants to the wider sector. As a result the Academy worked with the pilot institutions to build a distributed network of weblogs, one for each institution, one for each consultancy, and one for the Academy. The Academy and institutional weblogs were open for public viewing (at www.heacademy.ac.uk/ weblogs/benchmarking/) whereas the consultancy weblogs were restricted access vehicles for communication between the consultants and Academy. Guidance notes on the use of weblogs to support of the e-learning benchmarking exercise were posted (HEA, 2006).

Table 1: The pilot phase institutions and approaches

Approach	Pilot phase institutions
ELTI (Embedding Learning Technology Institutionally) (JISC, 2003)	University of Bristol, University of Hertfordshire, University of Wales Institute, Cardiff
Pick and Mix Approach (Bacsich, 2006)	University of Chester, University of Leicester, Staffordshire University
The Observatory of Borderless Higher Education Approach (OBHE, 2003)	Coventry University and Warwickshire College, Institute of Education, University of London, Oxford Brookes University, University of Warwick
MIT90s (Scott Morton, 1991)	University of Strathclyde
e-Learning Maturity Model (Marshall, 2005)	University of Manchester

Some issues in the pilot phase

There were a variety of issues that the Pilot Phase attempted to address:

- to establish a common understanding, among participating institutions, about what is meant by e-learning, embedding, and benchmarking.
- following on from this, if e-learning is embedded is it possible, easy, or desirable to try and isolate the exact contribution the 'e' made to the learning? If not, we end up not benchmarking e-learning at all, but something far broader.
- deciding on the most meaningful organisational unit for benchmarking: is it at institutional, faculty, school level etc?
- the extent to which the Academy should demonstrate leadership with regard to the direction of developing a diverse approach to benchmarking rather than 'champion' any single approach.
- to evaluate whether the 'constrained diversity' approach taken proved to be the correct one? The view taken was that a heterogeneous HE sector requires some degree of heterogeneity of approach.
- the extent to which institutions have prioritised development over comparison?

Evaluation conclusions and recommendations

The pilot exercise has revealed that institutions have found it more challenging than expected to assess with any real confidence the 'state of play' in e-learning, both within institutions and across the sector. On the other hand the process of trying to arrive at such an assessment has proved enormously beneficial to the institutions who have attempted it.

There was a widely-expressed view that all the benchmarking approaches adopted have been an important catalyst to institutional and community reflection and have acted as a starting point for a developmental process. The precise nature of the methodology has been much less important than the general process involved in starting to ask penetrating questions about e-learning in an institution. Two quotations from participants in the pilot neatly encapsulate the overall experience of the benchmarking pilot.

> ..the concept of benchmarking implies that we know what we're measuring, and that just isn't the case for e-learning. The more closely you look at it the more interconnected with everything else it seems to become, and the more difficult it is to assess its value to the student experience.
>
> For the first time we've been made to think quite deeply about what we're doing – not just about how we support e-learning, but about whether we're deploying our limited resources in a way that really helps students learn (Mayes, 2006, p. 2).

According to the pilot evaluator, Mayes (2006), some of the main recommendations from the evaluation report are as follows:

1. The main model trialled in the pilot – consultants appointed to interface with individual HEIs and directly supporting the institution in its use of a method – should continue.
2. The main benchmarking methods trialled in the pilot should remain on offer and should be supported, though institutions should be encouraged to regard them as flexible frameworks for starting a process of tailoring benchmarking for their own requirements, rather than as tools to be operated.
3. There should be no attempt to impose a single benchmarking approach across the whole programme.
4. The attempt to develop a benchmarking framework for e-learning should continue in the main phase, as a programme wide activity.
5. All institutions should be given maximum opportunity to share their experiences with other HEIs in a small cluster of institutions following a particular method
6. The attempt to create a culture of sharing of issues and outputs across the programme should be built on in the main phase, with institutional weblogs more explicitly supported.
7. A role should be found in the main phase for those participants in the pilot who have offered their expertise for the main phase of the programme.
8. The issue of how to benchmark progress in e-learning across the whole sector should be addressed. A level of reporting must be agreed that is consistent with institutional confidentiality but also allows a detailed picture of progress in particular areas to be more visible than in the pilot.
9. Consideration should be given to the possibility of giving an explicit role in benchmarking e-learning to the Academy's 24 Subject Centres.

Beyond the pilot: Developing the e-Benchmarking framework

The team driving the e-benchmarking Pilot Phase witnessed the emergence of, what is hoped could become a generic e-benchmarking framework. This would be developed by identifying:

- Any commonalities/core elements and processes identified by the sector in the existing approaches to e-benchmarking that could be distilled / refined and supplemented by context-specific elements.
- The synthesis of the approaches to draw out the development/enhancement of an HE specific e-benchmarking framework, grounded in the student learning experience.

An e-benchmarking framework shouldn't be confused with a preference for any particular e-benchmarking or institutional review tool. A framework should clarify the point of the exercise: how to measure the enhancement that technology brings to the learners' experience. However, it is essential that there is time to develop sector 'buy in' and contributions.

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Increasing success in first year courses: Assessment re-design, self-regulation and learning technologies

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Concerns about non-completion and the quality of the first year student experience have been linked to recent changes in higher education such as modularisation, increased class sizes, greater diversity in the student intake and reduced resources. Improving formative assessment and feedback processes is seen as one way of addressing academic failure, of enhancing the learning experience and students' chances of success in the early years of study. This paper argues that, if this is to happen, a broader perspective on the purposes of formative assessment and feedback is required; one that links these processes to the development of learner self-regulation. Drawing on the current literature, the paper presents a set of principles for the effective design and evaluation of formative assessment and feedback processes. It then shows, through two case studies drawn from a large £1m Re-engineering Assessment Practices (REAP) project, how ICT might support formative assessment processes, academic success and the development of self-regulation in large first year classes.

Keywords: formative assessment, feedback, self-regulation, first year experience, student success

Introduction

Across the higher education sector there is a growing interest in the quality of the student learning experience in the first years of undergraduate study. This interest is fuelled by statistics showing poor course completion rates and by recognition that the first year lays the foundation for learning in later years. Yorke and Longden (2004) in studying retention issues across a number of countries have identified four broad reasons why students leave academic programmes: (i) flawed decision making in initial choices; (ii) events that impact on students' lives outside the institution; (iii) students' experiences of the programme and the institution; and (iv) failure to cope with the academic demands of programmes. This paper is primarily concerned with the last two reasons: it explores how formative assessment practices might be used to enrich the first year experience and enable students to develop their capacity for self-regulated learning. It also explores how information and communication technologies (ICT) might support formative assessment practices. Case study applications, drawn from a large-scale re-engineering assessment project led by the University of Strathclyde, are used to illustrate some possibilities. A key idea in the retention and non-completion research is the need to maximise students' sense of, and chances of, success particularly when they enter HE and in the early years of study. The concepts of academic success and self-regulated learning are seen as inter-related in this paper.

Formative assessment and academic failure

There is considerable evidence that formative assessment with feedback has an impact on learning quality in education (Black & Wiliam, 1998; Knight & Yorke, 2003; Hounsell, 2003). In higher education, Yorke (1999) has shown that the number of opportunities available for formative feedback is an important variable in non-completion by students in the early years of study. Yorke and Longden (2004) have argued that, where students are uncertain about their ability to succeed, formative feedback is of particular significance. However, over the last 10 years, modularisation, larger student numbers in first year classes, greater diversity and reduced staff–student ratios have all had a negative effect on formative assessment practices. These negative effects include fewer opportunities for students to clarify what is expected of them, a reduction in feedback on assignments and in class, and an increased emphasis on summative assessment at the expense of formative assessment (Yorke & Longden, 2004). The latter has resulted in an excessive concentration by students on getting good marks and playing the assessment game rather than focusing their effort on deep and lasting learning (Gibbs, 2006). These changes have also been shown to impact on the students’ sense of self and on their motivation and self-confidence (Higgins, Hartley and Skelton, 2001).

How might assessment practices change in order to enhance the first year experience and increase students’ chances of success? A recent literature review carried out by Gibbs & Simpson (2004) was directed at addressing this question (see also Gibbs, 2006). They examined a wide range of case studies and were able to identify eleven conditions under which assessment might support student learning and increase the likelihood of academic success. The conceptual framework underpinning these conditions (and an associated assessment experience questionnaire) is based on two over-riding principles (see Table 1). The first principle, which draws on Chickering and Gamson’s (1987) research, is that assessment tasks should be designed to ensure that students spend their study time in productive ways: tasks should encourage ‘time on task’ (e.g. in and outside class), should lead to a more even distribution of study effort (over the timeline of the course), should engage students in deep rather than surface learning and should communicate clear and high expectations. The second principle is about the effective provision of feedback to students on their academic work: feedback should be of sufficient quantity; timely; it should focus on learning not marks; it should be related to assessment criteria and be understandable, attended to and actually used by students to make improvements in their work.

Table 1: Gibbs and Simpson’s (2004) eleven conditions

Assessment tasks [conditions 1–4]

- Capture sufficient study time and effort (in and out of class)
- Are spread evenly across topics and weeks
- Lead to productive learning activity (deep rather than surface learning)
- Communicate clear and high expectations.

Feedback [conditions 5–11]

- Is sufficient (in frequency, detail)
- Is provided quickly enough to be useful
- Focuses on learning rather than marks
- Is linked to assessment criteria/expected learning outcomes
- Makes sense to students
- Is received by students and attended to
- Is acted upon to improve work and learning

Gibbs and Simpson’s (2004) eleven conditions have been piloted in a range of courses across the UK, and internationally, particularly in science disciplines. The Formative Assessment in Science Teaching (FAST) project team have worked with teachers to analyse existing assessment practice, to propose changes suggested by the eleven conditions framework and to evaluate the effect of these changes (see, www.open.ac.uk/science/fdtl). Those using the eleven conditions for course redesign report positive benefits for student learning. However, despite these benefits, one limitation of the FAST conceptualisation, and the eleven conditions, is that they are largely about the teacher’s role in structuring appropriate assessment tasks and in providing feedback. It is the teacher who ensures that students spend their time productively on task and that they receive appropriate feedback. While what the teacher does is an important determiner of academic success, many researchers now maintain that rather than having a reactive role in relation to teacher created activities, students should be given a much more active and participative role in assessment processes (Boud, 2000; Rust, O’Donovan & Price, 2005).

For example, Yorke & Longden (2004) argue that a key component of academic motivation and success is that students perceive themselves as agents of their own learning. Indeed, these researchers maintain that the student perspective is the gateway to solving what they call the ‘retention puzzle’. If students are to have a sense of control over their own learning, then formative assessment practices must also help them develop the skills needed to monitor, judge and manage their learning. In line with this approach, the conceptual model underpinning formative assessment and feedback practices in this paper is based on developing learner self-regulation (see Nicol & Macfarlane-Dick, 2006). This perspective on feedback is wider than that provided by Gibbs and Simpson but it also usefully incorporates all of their seven feedback conditions. However, this paper does draw on the first four of Gibbs and Simpson's eleven assessment conditions. This recognizes the fact that, in HE, teachers, especially in the first year, need to provide a clear structure within which student participation in assessment activities is achieved. The key argument here is that both teacher defined structure and self-regulation are important in learning with the balance of these shifting as students move through a course and their undergraduate degree.

Alongside the need to rethink the purposes of formative assessment there is also a need to rethink the ways in which assessment is organised and implemented. Recent advances in information and communication technologies (ICT) are having a large impact on the delivery of student learning in HE. There is also a growing interest in the use of computers to streamline the provision of formative assessment tests and of feedback (Bull & McKenna, 2004). This paper builds on the work of Nicol and Milligan (2006) by demonstrating ways in which ICT can be used to support the development of learner self-regulation, the organisation of assessment tasks and the provision of feedback.

Self-regulation and student success

Formative assessment is defined in this paper as 'assessment that is specifically intended to provide feedback on performance to improve and accelerate learning' (Sadler, 1998 p. 77). Academics tend to think of formative assessment in terms of the judgements they make about students' academic work and the provision of feedback. However, this paper takes a broader view of the source of formative assessment. It is especially concerned with involving students in evaluative judgements about their own work and the work of their peers. The ability to monitor, critically assess and correct one's own work is a key goal of higher education and of lifelong learning.

In 2006, Nicol and Macfarlane-Dick reinterpreted the literature on formative assessment and feedback in relation to learner self-regulation. From this they were able to identify seven principles of good feedback practice that, if implemented, would contribute to the development of self-regulation (autonomy) in learning. Each of these principles is defined in detail in the earlier paper with the supporting research and examples of its implementation. Table 2 presents the seven principles.

Table 2: Seven principles of good feedback practice

Good feedback:

1 Helps clarify what good performance is (goals, criteria, standards)
2 Facilitates the development of self-assessment and reflection in learning
3 Delivers high quality information to students about their learning
4 Encourages teacher and peer dialogue around learning
5 Encourages positive motivational beliefs and self esteem
6 Provides opportunities to close the gap between current and desired performance
7 Provides information to teachers that can be used to help shape teaching.

Nicol and Macfarlane-Dick (2006)

The work of Nicol and Macfarlane-Dick builds on that of other researchers who have emphasised the importance of developing autonomy in both learning and assessment processes (e.g. Knight & Yorke, 2003; Boud, 2000). However, it departs from the work of others in one important respect. In the seven principles framework, the starting assumption is that students are already engaged in self-regulation but that some students are better at self-regulation than others; and it is the weaker students that need opportunities to enhance their sense of control. There are at least four reasons for this argument. Firstly, students are always informally engaged in the self-regulation of learning when they engage in academic tasks. They assume goals (e.g. write an essay) and they engage in purposeful activities while monitoring and regulating progress towards these goals. Secondly, active and constructivist conceptions of learning logically imply the notion of self-regulation (Winne, 2005). In constructing meaning students are assumed to be active agents of their own learning.

Thirdly, when students receive feedback from teachers they must engage in self-assessment if they are to use that information to improve academic performance: that is, they must decode the feedback message, internalise it and use it to make judgements about and modify their own work. This implies that self-assessment is at the heart of formative feedback (from teachers) and is a key component of self-regulation. Fourthly, students in some very large first year classes in higher education (e.g. over 500 students) receive almost no feedback and still make progress. Hence they must be making ongoing judgements about, and managing aspects of, their own learning – otherwise they would not be able to make progress. In summary, if students are already involved in self-assessment and self-regulation then the argument is that higher education teachers should build on this capacity rather than focus all their efforts on providing expert feedback.

The REAP project

The following sections present two case studies showing the ways in which assessment might be structured so as to enrich the first year student experience. Assessment is broadly defined to include formal and informal processes and self, peer and tutor feedback processes. In particular, each case study shows how the structure of assessment tasks (based on Gibbs and Simpson's four conditions) might be balanced with opportunities for learner self-regulation (based on Nicol and Macfarlane-Dick's seven principles of good feedback). Each case study uses different technologies – a discussion board, electronic voting systems and online tests. The context of these case studies is the Re-engineering Assessment Practices [REAP] project, one of six projects funded by the Scottish Funding Council under its e-Learning Transformation Programme.

The overall aim of the REAP project is to demonstrate learning quality enhancement and more effective use of staff time in large first year classes (150-800 students) through the application of learning technologies. The project involves three Scottish HE Institutions each piloting different approaches and technologies across a range of disciplines. The REAP project draws on current research on assessment (Nicol & Macfarlane-Dick, 2006; Nicol & Milligan, 2006; Gardner, 2006) with the key objective of assessment re-engineering being to lay a foundation for autonomy and self-regulation in learning during the first year (see www.reap.ac.uk).

Example 1: Psychology

The first year Basic Psychology course is designed to introduce all students to key findings, theories, and debates in general contemporary psychology. In addition the class provides an introduction to a number of specific areas of study within psychology which are dealt with in depth in second, third, and fourth year classes. The course comprises six topic areas delivered by 48 lectures, 4 tutorials and 12 practical laboratories over the year. The class size is approximately 550 students. Before the changes reported here, assessment comprised two paper-based multiple-choice tests over the year (25%), tutorials (4%), participation in an experiment (5%) and a final exam where students write five essays from twelve (66%). Feedback was only available through marks given on the multiple-choice tests and there were concerns that students were not given any feedback on their writing, essential for good exam performance. Technology-supported assessment was seen by the class leader as having the potential to enhance the first year experience, increase students' understanding of the topics being studied and enhance success in written work without increasing staff workload.

The pilot study

In the psychology pilot, the basic class was re-designed to provide opportunities for constructive formative assessment (scaffolding) linked to supportive peer discussion. This project draws on research showing cognitive gains where peer discussion is directed at the resolution of conflicting views (e.g. Anderson, Howe, Soden, Halliday & Low, 2001; Doise & Mugny, 1984). The discussion board within the institutional virtual learning environment (WebCT) is the technology in use.

Students were invited to participate in the pilot study, and 78 students volunteered (15% of the class). The students were divided into groups with a maximum of six students per group. There was an initial induction task where students were asked to introduce themselves to each other within their groups via the online discussion board. The main academic task followed this and involved students being presented with three questions of increasing complexity in a specific topic area (e.g. human memory) over a four weeks. For the first question (stage 1) they were asked to post an individual 50-word response to a private submission area in WebCT: other students could not see these individual responses. After all individual submissions had been received the students were then directed to engage in an online discussion within their groups about their answer; the instructions were to debate/argue what they believed the correct answer to be and then post an agreed 50-word response to the discussion board. For the second question they are asked to engage in online discussion in their groups and then to post an agreed 100-word response to the discussion board by a certain date. For the third question they also engaged in online discussion but the task required them to post a 300-word group response. Before students engaged with the second and third questions they were directed to a model answer written by the teacher; they could also retrieve a model answer after the 300-word response.

Key features of this pilot are that the task questions are progressively more difficult, that responses move from an individual to a group and that there is a model answer for comparison at each stage. Tutors did not provide any feedback; neither did they moderate the discussion. What is important here however is how this course design (i) applies the seven principles and helps develop learner self-regulation and (ii) creates a structure for assessment tasks that encourages frequent, but productive, learning activity (Gibbs and Simpson's four conditions).

Relation to seven feedback principles

- Standard format and model answer provide progressive clarification of expectations. (Principle 1)
- Students encouraged to self-assess (reflect) by comparing their responses against the model answers. (Principle 2)
- Online peer discussion around the learning task with the goal of reaching consensus about the group response. (Principle 4)
- The increasing complexity of the questions scaffolds learning development and the focus on learning rather than marks should enhance students' motivation. (Principle 5)
- The repeated cycle of topics and tasks provides significant opportunities to close the gap between desired and actual performance. (Principle 6)
- Tutors can monitor progress and adapt their teaching in relation to student's responses. (Principle 7) – *This principle was not enacted in the pilot but see commentary.*

Relation to four assessment conditions

- The individual and group responses require regular study activity out of class. (Condition 1)
- The tasks are staged for each topic over a number of weeks. (Condition 2) – *See commentary below regarding roll out to other topics.*
- The staged questions require progressively deeper levels of conceptual analysis. (Condition 3)
- The tasks have clear goals and there is a progressive increase in challenge. (Condition 4)

Commentary

Preliminary findings from focus groups and questionnaires show that the students were positive about this learning experience. They reported that working collaboratively enhanced their understanding of the discussion topic (92%). Typical student comments were "*we know everything there is to know about this topic now*" and "*I found it very beneficial, at the time… I did not realise how much I was learning…it was learning without thinking about what I was doing*". It is notable that these comments, and many others made by the students, emphasised both the way the task enhanced their confidence and the perceived benefits in learning. Another finding was that the early induction task where students introduced themselves helped create more supportive social interaction in the first year. This was evidenced through the extensive use of the discussion board for social postings. In traditional settings, being part of a large first year class does not guarantee, and may even inhibit, the establishment of social contact with others.

The findings from this pilot have given the Department of Psychology the confidence to propose a radical redesign of the first year class commencing in 2006/7, abolishing half the scheduled lectures and replacing these with similar online group exercises and making self-assessment and peer feedback core components of the class. These online tasks will become progressively more demanding within and across the six taught topic areas as the year progresses (memory, social psychology etc.).

Example 2: Mechanical engineering

The second example explores how a range of technologies including electronic voting systems (EVS) are being used to support assessment practices and the development of learner self-regulation in mechanical engineering. Eight years ago the Department of Mechanical Engineering at the University of Strathclyde embarked on a radical change in its teaching methods for first year students (see Nicol & Boyle, 2003; Boyle & Nicol, 2003). The aim of the New Approaches to Teaching and Learning in Engineering (NATALIE) initiative was to introduce collaborative learning in large lecture classes. The standard lecture/tutorial/laboratory format was replaced by a series of two-hour active-learning sessions involving short mini-presentations, videos, demonstrations and problem-solving all held together by peer instruction. Peer instruction is a form of Socratic Dialogue or ‘teaching by questioning’ pioneered by Mazur at Harvard (1997) using electronic voting technologies.

A typical peer instruction class would begin with the teacher giving a short explanation of a concept or presenting a video demonstrating the concept (e.g. force in mechanics). This is followed by a multiple-choice question test (MCQ). Students respond to the concept test using handsets (similar to a TV remote) that send signals (radio frequency or infrared) to receivers linked to a computer. Software collates responses and presents a bar chart to the class showing the distribution across the alternatives. In peer instruction, if a large percentage of the class have incorrect responses the teacher instructs the class to: ‘convince your neighbours that you have the right answer’. This request results in students engaging in peer discussion about the thinking and reasoning behind their answers. The learning gains from this procedure have been interpreted in terms of cognitive conflict and scaffolding, both of which have been shown to benefit learning (Nicol & Boyle, 2003). After the discussion the teacher usually retests the students’ understanding of the same concept. Another strategy is for the teacher to facilitate ‘class-wide discussion’ on the topic by asking students from different groups to explain to the class the thinking behind their answers to the MCQs: explaining the reasoning behind incorrect as well as correct answers results in lively discussions. The EVS sequence usually ends with the teacher clarifying the correct answer. There are many other ways of using EVS to facilitate interaction and collaborative learning, and EVS have been used across a range of disciplines (see Draper & Brown, 2004; Banks, 2006). In Interactive Mechanics, where EVS is used, class size is 260 students (there are two sessions of 130 with each EVS class lasting two hours). Summative assessment comprises 10 fortnightly written homework exercise, a two-hour class test and a written exam.

Through REAP project funding, the Department of Mechanical Engineering is piloting new uses of EVS software (e.g. ranking tests) as well as other web-based tools such as Intelligent Homework Systems. Two developments are important in relation to this paper. Firstly, the use of online tests has been integrated with the use of electronic voting. Students are presented with online problem solving exercises or MCQs before the in-class EVS sessions. The teacher then uses the results of these tests to establish areas of weakness and to determine the focus of the classroom EVS sessions. This procedure, often called ‘just-in-time-teaching’ (Novak, Patterson, Gavrin & Christian, 1999), is a way of targeting teaching to students’ needs and level of understanding. A second innovation is the use of confidence or certainty-based marking (CBM) during EVS sessions. This uses multiple-choice questions but students must also rate their confidence (certainty) in their answer (see, Gardner-Medwin, 2006). This is being piloted as formative assessment using the rules in Table 3, with the intention of using this for summative assessments at a later time. CBM requires that students engage in meta-cognitive thinking – that they step back and reflect deeply about whether there is good justification for their answer.

The use of EVS in Mechanical Engineering is a powerful example of a highly integrated implementation of the feedback principles and conditions using more than one technology. However, for the sake of analysis we have separated out the implementation of each principle/condition as it applies to this course.

Table 3: Scoring regime for certainty-based marking

Degree of Certainty	C=1 Low	C=2 Medium	C=3 High	No reply
Mark if correct	1	2	3	0
Penalty if wrong	0	-2	-6	0

Relation to the seven feedback principles

- Learning goals in class are clarified through iterative cycles of tutor presentation, testing and re-testing of concepts using MCQs. (Principle 1)
- Opportunities for self-assessment and reflection are available when the teacher provides the correct answer to the concept question at the end of an in-class EVS test sequence. Students also reflect on their answer during confidence-based marking. Reflection is also possible after the bar chart presentation of class response. (Principle 2)
- Teachers normally provide feedback in class in response to students' questions and at the end of each concept test sequence to clear up any misunderstandings. (Principle 3)
- Peer dialogue is integral both to peer instruction and class-wide discussion with specific student-tutor dialogue occurring during class-wide discussion. (Principle 4)
- The EVS class focuses on learning goals rather than performance goals (i.e. grading) and there is step-by-step progression in difficulty of the concept questions – both processes are known to enhance motivation. (Principle 5)
- The continuous cycle of tests, retests and feedback ensures that students have opportunities to 'experience' a closing of the gap between desired and actual performance. (Principle 6)
- A great deal of information is available to the teacher about areas of student difficulty that is deliberately used to shape teaching. The bar chart feedback provides instant feedback about difficult topics and asking students to explain answers during class-wide discussion uncovers misconceptions. The information provided before class through the web-based MCQ tests also informs in-class teaching. (Principle 7)

Relation to the four assessment conditions

- The web-based assessment tasks (MCQs and problem solving exercises) keep students engaged in out of class activities and EVS exercises encourage engagement in class. (Condition 1)
- EVS activity is distributed across topics and weeks. (Condition 2)
- EVS tasks are designed to deepen learning as evidence of students' understanding increases in topic areas. (Condition 3)
- The EVS activities clearly communicate what is required and there is a progressive increase in challenge. (Condition 4)

Commentary

Extensive evaluations have been carried out in this engineering mechanics course showing significant learning gains (Nicol & Boyle, 2003; Boyle & Nicol, 2003). Overall, the changes have been a huge success both in terms of student end of year performance in exams and in terms of retention. There has been a reduction from 20% non-completion to 3%, the largest gain in any course within the University. Also, since the introduction of concept testing using electronic voting, attendance in class remains high throughout the year unlike similar lecture-based classes. Further evaluations of confidence-based marking and intelligent tutoring are now being carried out. While there is a great deal of research on the benefits of using of EVS to support learning (see Banks, 2006), this is the first analysis from a formative feedback perspective. This analysis provides new insights into how the different component processes (self, peer and tutor feedback) interact and reinforce each other. A fuller explanation of the power of EVS interventions in other contexts might also benefit from this kind of analysis.

Discussion

The two case studies reported above show how ICT might be used to support a broad range of assessment processes in large first year classes. A key issue in the literature on formative assessment is how to move students from being dependent on teacher feedback to being able to generate their own feedback on learning. These case studies address this issue in that they both involve elements of self-assessment, peer and teacher feedback, implemented in ways that support the development of learner self-regulation. But what are the potential limitations of these methods? Firstly, it should be pointed out that the Psychology case study is currently in pilot mode and there is a need to scale this up to the complete student cohort of 550 and carry out a full evaluation. A second issue concerns the balance of learner self-regulation and teacher direction. In these case examples, one might argue that it is still the teacher that is directing students' learning by setting the discussion tasks and by determining the timing and nature of learner interactions with subject matter. Hence the approach adopted might not fully address the concerns of researchers who believe that changes in tutor-student power and authority relationships must take place for feedback to impact on learner self-regulation (Higgins, Hartley & Skelton, 2001; Taras, 2002) or that students must actively participate in the construction of assessment criteria if they are to understand the meaning of feedback (Rust, Donovan & Price, 2005)

In addressing this issue, it is important to note that there is considerably more autonomy built into these classes than in traditional teaching approaches. For example, in the psychology course the students collectively construct their understanding of criteria as well as their responses through group participation and dialogue. In addition, the proposed use of student created model answers (to replace the teacher model answers) as the basis of self-assessment will take this a step further (see below). A second point is that these are first year classes and a clear structure for learning might be appropriate at this level. Yorke and Longden (2004) suggest that regular and structured tasks help students appreciate the kinds of learning expected and provide early opportunities for feedback and guidance from tutors. However, it would be possible to strengthen learner autonomy within these case studies and relax teacher control. For example, one criticism of the EVS procedure might be that student learning is driven by MCQ tests formulated by the teacher. But this could be addressed by having students construct MCQs themselves for use in the classroom as was done by Fellenz (2004). This would actively engage them in generating assessment criteria and example questions within their own subject discipline (strengthening the enactment of principle 1). Similarly, in the psychology case study it would be possible to have students actively formulate the discussion questions. What these examples show is how each of the seven principles might be used as a reference point when trying to strengthen support for self-regulation in the course design.

Two pedagogic issues have been raised about the Psychology case study. Firstly, the use of model answers written by teachers has led some researchers to suggest that this will encourage in students the belief that there is a right answer and that this is counter-productive in the first year. The psychology department intends to address this issue by replacing the teacher answers with two or three selected model answers from those posted by students. This will not only help address the single answer issue but should also be motivational to the student group (principle 5). Another issue is free-rider effect where individual students might contribute little to the group response posted on the discussion board. This is being addressed in the redesign where the students will now be required to make an individual contribution before the group discussion for each response type (50, 100 and 300 word responses not just for the 50-word response). Also, once a final group response has been agreed through peer discussion, each student will be required to submit a copy of that response to the virtual learning environment. While individual and group responses will not be marked they will be a course requirement (compulsory) and graduate teaching assistants will monitor contributions. These refinements should help minimise free-rider effects.

A key consideration from the REAP project perspective is that the psychology and mechanical engineering redesigns do not increase staff workload. In psychology, the proposal to half the lecturing workload and the use of graduate teaching assistants to monitor student contributions points to similar overall costs. However, there has been a significant increase in feedback opportunities. Before the project began students received almost no feedback. Now the learning environment is rich in opportunities for self and peer feedback. Overall, the psychology case study is an excellent example of an elegant and efficient learning design. Moreover, the design plan is easily transferable to other courses and is simple to implement: it only involves a standard tool available in every virtual learning environment (discussion board). Similar arguments could be made for mechanical engineering.

One interesting observation from the Mechanical Engineering case study is the role played by MCQs. Many writers have noted the limitations of MCQs, for example, that they encourage surface low-level learning (e.g. Scouller, 1998). Yet, the Mechanical Engineering example provided here shows that it is not the test itself that is important but the context of its use. Considerable power is gained when MCQs are linked to peer discussion in the EVS classroom and when the implementation includes a blend of online and offline interactions (as with the just-in-time-teaching scenario).

A key outcome of the REAP project is the value of having robust assessment and feedback principles (and conditions) derived from research, when thinking about the design of assessment practices. In this paper, Nicol and Macfarlane-Dick's (2006) seven feedback principles and Gibbs and Simpson's (2004) four assessment conditions have been brought together to provide a broad framework for examining course design and the balance between learner self-regulation and teacher direction. As well as being important in learning design, such principles are also valuable in the evaluation of changes in assessment practice.

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Professional development for professional developers: Who's learning about e-learning from whom?

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This paper examines the critically reflective approach of a group of academic support staff in the design, development and evaluation of an e-learning resource. The resource was a showcase of examples of electronic learning and teaching approaches developed at Monash University titled Designing Electronic Learning and Teaching Approaches (DELTA). This paper does not focus on the resource itself, but rather on the critically reflective approach used, which drew on the features of participatory action research and was extended to include a participatory component in the evaluation of the site so that the outcomes of this process could be formally accommodated in data collection. The paper explores this critically reflective approach as a model for e-learning developers to monitor and progress their own professional development, engaging in collaborative dialogue to enhance their professional practice.

Keywords: teaching and learning strategies, educational paradigms, research methods and approaches, learning communities/collaborative learning, personalised learning

Introduction

As universities adopt new technologies to support teaching and learning, staff development for pedagogically appropriate use of these technologies becomes imperative. Epper and Bates (2001, p. xv) describe staff development and training as a 'daunting challenge', and others (Bates, 2005; Kulski, Boase-Jelinek & Pedalina, 2002; Taylor, 2003; Shephard, 2004; Wilson & Stacey, 2004) have repeatedly brought attention to the need for professional development in the area.

Teaching academics benefit from support to translate their teaching into non-linear, flexible, collaborative, e-supported environments and to gain confidence in using the technology. Educational designers and staff developers can help teaching academics to reconceptualise what they do and to use technology effectively. In recognition of such a need, an exemplars *WebCT* site titled Designing Electronic Learning and Teaching Approaches (DELTA) was developed by a team of academic support staff involved in educational design and academic professional development at Monash University, Australia. DELTA demonstrates good practices in e-learning by showcasing examples of and ideas for learning and teaching with technology. DELTA was presented within *WebCT Vista* (the University's learning management system) to support the time-poor teaching academic, facilitating broader, flexible and 'on demand' academic staff development opportunities as part of a strategy to develop a University-wide suite of online and offline support opportunities to complement *WebCT* training. The principles that guided this approach to staff development included iterative development of strategies for learning and teaching with technology, reflective practice, mentoring in the area of new skills development, learning from demonstrations by colleagues, and cross-faculty sharing and exposure. For further details about the design and evaluation of DELTA see Samarawickrema, Benson and Weaver (2005).

This paper explores the experiences of the six members of the academic support group involved in the design, development and evaluation of DELTA, in the context of participatory action research. It focuses on the critically reflective approach which was adopted, examining it as a model for professional development of academic support staff working in areas of innovation and e-learning where formal professional development programs are few. The individual and collective reflections of the group, articulated through dialogue, contributed to the professional development of the group members themselves. While the conversational framework developed by Laurillard (2002) provides one way for conceptualising this experience, the emphasis on the empowering aspects of participant collaboration embedded in the concept of action research (Carr & Kemmis, 1986; Kemmis & McTaggart, 1988) offers a further dimension for exploring the implications of participation for professional development.

Professional development and participatory action research

The use of action research as a model for staff development in higher education is not new (Kember & Gow, 1992; Grundy, 1995). Webb (1996, p.59) noted a decade ago that 'Apart from phenomenography, action research is perhaps the most influential and almost certainly the fastest-growing orientation towards staff development at the present time.' Action research is particularly applicable to staff development because it supports critically reflective thinking about one's own practice, is grounded in the principles of teamwork and collaboration to forge new meanings from experience, and offers a clear framework for acting on these (Brookfield, 1995; Carr & Kemmis, 1986; Kemmis & McTaggart, 1988). Although its roots in the critical theory paradigm (with ideas of change through emancipation and empowerment) may seem far removed from the context of a small e-learning development team, Brookfield (1995), among others, has highlighted the relevance of critical pedagogy in understanding our roles in education. He refers to critical reflection as an 'illumination of power' (p.9): it allows us to understand how power frames and distorts our educational processes and interactions and to question our assumptions and practices that are taken for granted as being good for our teaching, while participation provides an avenue for making our thinking public. Other benefits include its support for taking informed actions, developing a rationale for practice, avoiding self-blame, emotionally grounding us, enlivening our classrooms, and increasing democratic trust. Action learning principles have been acknowledged as important in professional development for e-learning (Ellis & Phelps, 2000), and there has been some recognition of the advantages of action research for professional development in this area (McPherson & Nunes, 2004), but there appears to be scope for wider application of these ideas and practices.

It became clear from the early stages of the design and development of DELTA that the conversations we engaged in as we expressed our design and development priorities, or debated the merits or otherwise of particular examples for inclusion, were exposing our pedagogical values, extending our thinking and creating shared ownership of the decisions made. Hence, in the tradition of Freire (1972), it was evident that we were demonstrating how '*humans in communication are engaged actively in the making and exchange of meanings*, it is *not* merely about the *transmission* of messages' (Evans & Nation, 1989, p.37). We realised that our dialogue was a vehicle for our own professional development as well as offering clear directions for action. Consequently, when planning the evaluation of the site, it seemed obvious that one component should involve a participatory process to facilitate the formal collection of our own critical reflections in order to include these, alongside data from other sources, to inform its ongoing development.

Implementing the participatory evaluation process

In extending the concept of participatory action research to participatory evaluation we were acknowledging the close links between these two forms of enquiry (Greenwood & Levin, 1998; Jackson & Kassam, 1998; Patton, 2002). Participatory evaluation as a 'formal, reflective process [people undertake] for their own development and empowerment' (Patton, 2002; p.183), provided us with a way of documenting our individual and collective perceptions of the site, as a means of reaching consensus on priorities emerging from the evaluation. While participatory evaluation is frequently applied in a community development context, our use of it at a micro level appeared appropriate to the team-based nature of our work, allowing us to move from individual reflection, to identification of areas of consensus through dialogue, and then to prioritisation of the actions to follow. The process we used was as follows:

1. Collectively identify aspects of the DELTA site for evaluation.
2. Individually write a 200 word response to each of the (five) aspects identified, summarising each response in one or two sentences.
3. Compile, circulate and reflect individually on the compiled responses.

4 Meet in a focus group facilitated by a critical friend to identify consensus items.
5 List separately the consensus and non-consensus items and prioritise the former for action.

This participatory evaluation process exposed the values of individual members of the group in a non-threatening way, allowing for a merging and reconceptualising of shared understandings. It also provided for group ownership of the priorities for action, thus simultaneously supporting both the evaluation and professional development of the team members. Results from the above process included consensus on the characteristics of good examples and the process of selecting them. For example, we agreed that examples should be realistic, achievable, exploit the unique capacities of the technology, establish the learning context, demonstrate good pedagogy, engage learners and address their needs, and be identified by intuitive titles. Consequently, we validated the existing examples as well as confirming the selection process for future examples. On the overall site design, we shared the view that the ability to browse from different user perspectives was needed, and improved search capabilities, which led to refining those design features. There was also consensus that as a resource for academic professional development, DELTA's use varied according to user needs (confirmed through other evaluation strategies), and that the process of selecting examples was indeed a professional development activity in itself. Considering the evaluation questions collaboratively reinforced a shared accountability in the changes we made to DELTA and the value of learning from each other by developing and refining our individual ideas about e-learning.

Discussion and conclusion

The process described above illustrates how participatory evaluation provided a form of data collection that allowed our own merged understandings to be considered alongside data from other respondents through other evaluation strategies to improve the site. It helped formalise a process which we had recognised as an informal participatory action research cycle during the dialogue which underpinned DELTA's design and development. By formalising, documenting and managing the participatory evaluation process, we not only owned our individual contributions but also consented to the way in which these activities were carried out, thus taking ownership of the process as a whole. From ownership comes empowerment, a powerful motive for change. Brookfield (1995) notes that changes that occur from participatory action methods consequently generate personal or life change for participants. In our case, undertaking such an approach as part of the evaluation meant we could take responsibility for our own quality monitoring of DELTA and its ongoing development as a key outcome, providing an implementation method to allow action to follow.

The team-based nature of e-learning development lends itself to participatory action research as a model for professional development, particularly given the volatile state of emerging knowledge in the area, its contextualised nature, and limited formal professional development opportunities. The context of developing a professional development resource for others, out of the experiences of others, offers the potential of an ever widening circle of participation with new understandings emerging through reflection and dialogue. Consequently, in relation to our own professional development, as experienced through the participatory evaluation process outlined above, the answer to the question 'who's learning about e-learning from whom?' is, to some extent, that we are learning from each other. However, the processes of participatory action research and participatory evaluation take the learning to another level: the sharing of knowledge and values results in the making of new meaning so that rather than learning *from* someone, we are learning together, sharing experiences, drawing from and contributing to an existing knowledge base that benefits the wider e-learning community.

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The trial of learning objects: Exploring the design and delivery of VTE courses with learning objects

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This paper describes a project undertaken in the Australian vocational training and education (VTE) sector that sought to investigate success factors associated with the design and delivery of courses using learning objects (LOs). The project explored the strategies used by three teachers as they used digital repositories to discover learning objects, and then applied the objects through a content management system to create online courses. The paper reports the factors that were found to influence the online learning settings that resulted and teachers' perceptions of LOs as building blocks for online courses.

Keywords: learning objects, learning designs, vocational education, teacher uptake

Learning objects

The concept of learning objects as reusable digital learning resources is popular among many of the stakeholders involved in elearning. There appear to be many advantages to be gained from being able to reuse digital resources in learning settings and much has been written on the topic of reusability as both a design and development strategy for online learning materials (e.g. Rehak & Mason, 2003). Learning objects have the potential to exert considerable influence on the actions of the vast majority of people associated with elearning including such stakeholders as:

- administrative and financial personnel who look to benefit from the potential costs savings associated with reusing and sharing learning resources
- policy-makers who are interested in the legal and ethical implications of copyright and intellectual property among the shared objects
- instructional designers who need to consider design strategies that facilitate and support sharing and reuse, and
- developers who need to consider appropriate development strategies to ensure interoperability and a capability for use of resources beyond the context for which they are designed (e.g. Downes, 2000; Shepherd, 2000).

Apart from the cost savings that stem from reduced development needs, there is also the advantage of being able to provide learners with access to increased levels of resources. When there are ample reusable resources, teachers and students can select from among those available to choose the most appropriate and the best quality. Reusable resources facilitate the sharing of materials among and between groups, an activity that will likely lead to improved outcomes in terms of providing alternative perspectives and a multiplicity of content sources (Agostinho et al. 2004).

Facilitating the use of learning objects

Much of the current work with learning objects is seeking to explore and provide the enabling systems and processes for teachers to be able to discover and locate online resources that can be seamlessly incorporated into the learning environments they are building (Beetham, 2004). When one examines the current practice and nature of elearning in general, there are many factors that potentially limit the goals and aims of the learning object movement. For example:

- learning resources come in a huge variety of forms and sizes
- most elearning resources are developed and built for personal and local use without regard for reuse beyond the immediate context
- they are built from a variety of technologies and in a variety of architectures which tend to tie them to particular platforms and operating systems, and
- the resources have often been designed for use in a single setting, with hard links and connections that cannot be easily disconnected if the materials are to be used elsewhere; The resources contain references and descriptions from the local setting which could be out of place if the materials were reused (e.g. Wiley, 2003).

The collection and storage of learning objects

For teachers to be able to use learning objects, they must have access to repositories and databases where the resources have been collected and stored. The repositories need to provide access to resources that are developed in standardised ways and interoperable across many systems. A considerable amount of research has been conducted to explore appropriate ways to develop resources, to gather and evaluate their potential for reuse and to effect their inclusion in accessible collections. Specifications for digital repositories have been an important element in the process to develop standards for learning objects. A digital repository is a collection of digital resources that can be accessed through a network requiring no prior knowledge of the collection’s structure. Repositories usually hold many forms of digital resource including their metadata descriptors, although the metadata need not necessarily be stored with the various assets. The specifications for digital repositories that are currently being developed by IMS include object querying and locating functions. Recommended standards include the W3C XQuery (2003), W3C SOAP (2000) the simple object access protocol, and ZOOM (2003), the Z39.50 object oriented model.

Given that there are not large numbers of learning objects in the public domain, it is important for those which are able to be used, that teachers are able to discover them. In recent years a standard set of descriptors (metadata) has been developed to describe and help identify the content of learning objects. (LOM, 2002). The Learning Objects Metadata comprises a wide range of relevant descriptors which are intended to enable learning objects to be accurately described to assist in their choice for reuse. At the same time the metadata descriptors enable objects to be distinguished and provide searchable information about an object’s form and content.

There are many, however, who believe that the metadata processes used to describe learning objects are still limited. Even with metadata standards, there are still difficulties to be faced in the discovery of learning objects. Often the metadata applied to resources is inaccurate and incomplete and unable to distinguish between resources (e.g. Brownfield & Oliver, 2003). Another concern is the lack of data that is attached to learning objects that provide descriptions of their learning attributes (e.g. Jonassen & Churchill, 2004). Whilst the metadata provides strong descriptions of the technical aspects of the object, there tends to be very limited information concerning the instructional elements of many of the stored objects and this reduces their potential for discovery and reuse.

The application of learning objects in the Australian VTE sector

Since 2003 the Australian Flexible Learning Framework has been investing heavily in the creation of quality learning resources for the Australian VTE sector. This has included the development of Toolboxes, fully stand-alone online courses for training packages. The Toolboxes have been designed to meet international standards allowing them to be disaggregated easily into shareable learning objects. Some Toolboxes developed prior to 2003 have also been repackaged into reusable forms to enable their use as learning object by VTE practitioners (Oliver et al. 2005). A prototype Digital Repository was developed in 2003 to store and provide access to many thousand of digital resources, learning objects from the Toolbox projects (Brownfield & Oliver, 2003).

The widespread implementation and use of courseware management systems (CMS) in the Australian VTE sector, together with the provision of relevant learning objects in accessible repositories appear to provide golden opportunities for VTE teachers to develop and create online learning resources for their students (Hand, 2004). To that end the Trials of Learning Objects (TLO) was commissioned by the Flexible Learning Advisory Group in 2005 to investigate the capability of existing systems to support teachers' development of quality online courses. While the plethora of technology-supports and digital tools and resources for learning has garnered strong interest among teachers to employ ICT as a mainstream component of course delivery, in practice, the technology-supports and templates often encourage less effective approaches to learning (Britain, 2004). Teachers have been found to still require substantial theoretical and practical guidance in the design of effective e-learning strategies and activities (Littlejohn, 2004). The TLO sought to explore how VTE teachers/trainers could access and use available learning objects and to explore the degree to which current infrastructure could support this form of use. The project also sought to investigate the factors impeding and supporting the development of effective learning settings using these technologies.

Project description

The aim of the TLO was to explore how LOs could be used to create quality learning settings and to discover how best these opportunities might be provided to other teachers in the Australian VTE sector. In particular, the project sought to:

- identify the conditions needed to successfully support teachers/trainers in deploying learning objects in their teaching programs including the level and nature of organisational and technical support required
- examine the pedagogical approaches (method of delivery) employed by teachers/trainers in utilising learning objects in a variety of VTE settings, eg, face-to-face, blended or workplace delivery
- identify the integration/sequencing strategies employed by teachers/trainers in using learning objects within their existing training program and teaching plans, and
- identify the skills and/or professional development activities teachers/trainers required to optimise their delivery using learning objects.

The outcomes from this project were intended to inform the VTE community and possibly the wider education community of the advantages and opportunities of re-using and sharing learning objects and resources and strategies needed to advance such activities among mainstream teaching.

Participants

The project involved volunteer VTE teachers who responded to an expression of interest posted nationally. Teachers willing to develop online courses using LOs were invited to join the project. Project participants were offered both technical and educational support as incentives for volunteering but were faced with quite tight timelines for their involvement. There was considerable degree of initial interest in the project and in the end three teams were considered to be strong applicants and invited to join the project.

Team A comprised a single teacher with substantial experience in the use of ICT in teaching and learning in Tasmania. The teacher had previous experience in the complexities of customising resources and participated in the project to further her interest in learning objects and tools for the assembling of elearning resources. Team B comprised three teachers working in a small company in regional Queensland. The team was experienced in delivering face-to-face training and the project was their first experience in an online learning environment. Team C comprised two people who operated a very small private training company, with no physical 'institute' as such. This team delivered face-to-face training in the food processing industry and had considerable experience in conventional training methods and limited experience in ICT-based delivery.

A technical mentor was appointed to work with the three teams of VTE practitioners. The mentor had extensive technical and pedagogical experience and expertise relating to reuse of digital resources. The mentor provided a number of supports and scaffolds for the participants including:

- the production of a kit/training manual for the participants describing strategies for discovering and accessing LOs
- instructions in the use of an appropriate content management system
- instructions and tips for creating a learning sequence using learning objects, and
- ongoing phone and/or video conference support throughout the project.

Project supports

All participants were provided with access to TAFE Tasmania's Repository (Figure 1), a component of the Learning Object Repository Network (LORN). The objects accessible in this environment include those developed in an ANTA project to support online learning across a variety of qualifications. In particular there were a number of repackaged objects from recent projects, for example the Series 7 Toolboxes. The repository is organized around a powerful content management system, The Learning Edge (TLE). TLE provides search and retrieval functionality as well as an area where practitioners can recontextualise learning objects and materials and finally sequence them in the Content Module area of the Assembler in preparation for delivery. TLE enables users to develop fully conformant resources that can be delivered from the Content Assembler to an IMS/SCORM package for use in any online delivery setting e.g. WebCT, Moodle. Within The Learning Edge, teachers are able to reuse existing content from a variety of sources including their own materials and other materials stored and provided by others. TLE provides the means for teachers with minimal ICT skills to develop comprehensive learning materials for online delivery.

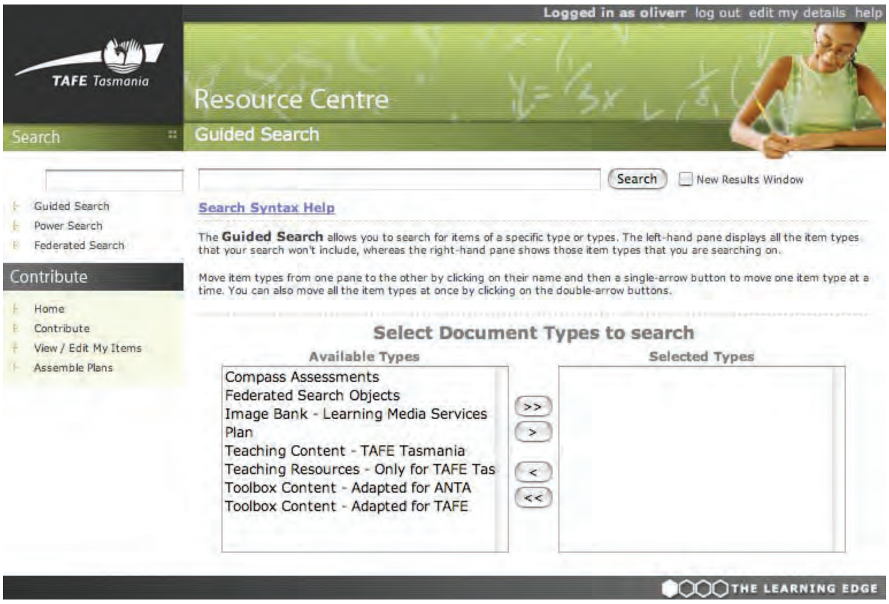

Figure 1: The learning object repositories used in the trials of learning objects

Development of the online resources

The members of the teams were all provided with hands-on training and support to demonstrate the TLE and how it could be used to access learning objects and to implement them in a form that could be delivered by a CMS. The technical mentor travelled to each team and worked with members of the team in a number of structured sessions to develop their skills in searching and choosing LOs, downloading them to their own workspace, placing them into an organised sequence, customising pages to suit the local context and importing the products into a CMS for delivery. During the training sessions, the teams were given instructional support and learning and teaching ideas by other members of the project team.

In Team A, the teacher developed two online courses for students, Use Business Technologies (UBT) and Occupational Health and Safety (OHS). Both courses used The Learning Edge to locate useful resources from the repository and to download them. To complement the resources found on the repository, the teacher discovered a number Excel and PowerPoint files from other sources and included these as resources in her learning setting. The use of the scenario and the various resources provided an authentic context for learning which was the teachers' intention and planned learning design. The Use Business Technologies unit was planned to incorporate a blended learning design that involved a mix of face-to-face instruction with individualised computer-based instruction. The learning design was based around a series of authentic tasks that formed the basis of the assessment and the learning activities. This course was developed using a number of development tools including The Learning Edge and Dreamweaver. The online component was built as a series of activities/resources that learners accessed through a WebCT interface. The Occupational Health and Safety Course online environment was developed with resources from available repositories. The units were delivered in a face-to-face mode across five 3 hour sessions at a Tasmanian TAFE Institute. They ran with 20 participants, all with varying and diverse prior experience with ICT in their workplace and home settings.

Team B developed a unit entitled WorkPlace Well Being (WWB) as an online version of an existing face to face course developed by the organisation. The emphasis was on self-directed learning and the measurement of learning outcomes. Key features included facilitated peer-to-peer communication using online tools, such as real-time (synchronous) chats and asynchronous (over time) discussion forums. In this eight week course there were five main topics. This blended online course covered a variety of topics to help develop and support mentally healthy workplaces. The learning design applied in the course for Topic 1 could best be described as informed conversation. The course aimed to promote students' understanding of issues associated with wellbeing in the workplace. In this topic students consider their current knowledge and understanding, read informed views and comments and then share their perceptions with others in an asynchronous communication. The learning occurs through the reflective reading and the online communication (at least two posts were required).

The site contained a variety of learning resources that students were able to access. The nature of the learning design employed meant that the resources could be used in ways that the students chose rather than being delivered in ways that restricted access to particular instructional forms. The resources themselves comprised mainly Word documents, and various Web documents in the form of pdf and HTML pages. The site included materials sourced from a variety of locations including Web sites, previous courses and resource collections owned by the developers. Within the resource set were a small number of resources obtained from the learning object repository provided by the Flexible Learning Toolboxes project, all delivered using Moodle (Figure 2).

Figure 2: The workplace wellbeing delivery format

The unit was delivered to a cohort of 12 students in an online mode across a 10 week period. Several staff facilitated and encouraged online participation through both synchronous and asynchronous modes with strong levels of tutor moderation. There were 6 students who formed the core of the online discussion with the remaining 6 students participating with less involvement in the discussions and communications components. The course represented typically about 12 hours of learning time for the students.

The third team constructed their planned online course in The Learning Edge, comprising four modules (Figure 3). Each of the four modules was designed to provide a self-contained online course for the students. The first module was designed to develop students' mathematical skills and capabilities and was derived from learning objects found in the repository. A front page describing the context and purpose was provided with a link to the actual learning activities. The learning design employed was driven very much by the forms of learner activity supported by the LOs taken from the repository. The environment included tasks which typically involved reading descriptions and elaborations and completing small consolidation and rehearsal activities. The majority of the learning outcomes related to acquisition of knowledge and the learning tasks tended to be low order tasks aimed at encouraging reading and some consideration of, and reflection on, the information.

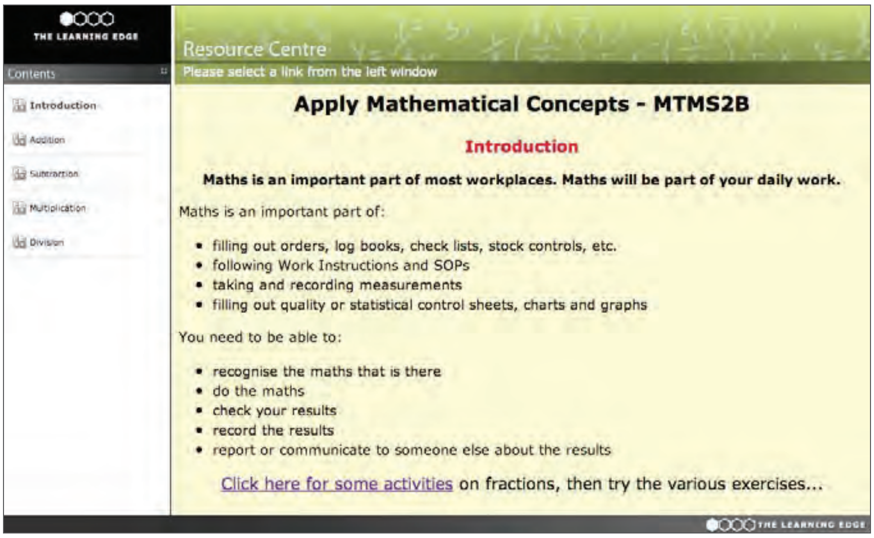

Figure 3: The introduction to the mathematics module within the learning edge setting

The design of the materials tended to involve creating a sequence with the chosen LOs and using the learning designs they contained as the basis for student activity. The resources were a mixture of Web pages from discrete LOs. Whilst the learning setting was intended for learners in the meat processing industry, it contained resources that had been designed for a variety of different learning settings. The mathematics activities were planned originally for building and construction and contained tasks relating to measurements etc. from this industry. The safety and health resources were drawn from learning settings designed primarily for health workers and related to hospital and medical sites.

In most instances the resources comprised Web pages with graphic and text. Some interactive elements were included but these were quite limited in their scope. Overall the resources were plentiful but limited in their media richness. Eight students participated in the trials and completed the course across a five week period. The students worked independently to complete the learning materials under the guidance of their tutor. They completed both modules as described above.

Outcomes and findings

The TLO project yielded many interesting outcomes in relation to how the teachers used the LOs in their lesson design and the types of learning environments that resulted. The project was limited in many respects in terms of the number of participants and the period over which it was conducted. The following findings are drawn from patterns and themes that emerged during the TLO. They are drawn from the observed practices and from attempts to determine causal relationships between what was observed and the reasons that may have led to the outcomes.

a) The use of a stable and powerful content management system provides strong support for designing online learning units using learning objects
The participants in the Trial of Learning Objects used The Learning Edge content management system as the means by which they assembled and structured the learning objects into a SCORM-compliant form. This tool is a complex tool with many components and functional elements. With only small amounts of (well-delivered) instruction and support, even the least technical teachers in the trials were able to develop sound mental models of the system and its operation. Many of the teachers who will use learning objects may have low levels of technical skills and confidence. The infrastructure and supports for e-learning environments use many acronyms and many technically confusing options and the settings are likely to present many barriers to novices. The use of a conceptually sound tool like The Learning Edge, when coupled with sound professional development support, will enable all teachers to make use of repositories and learning objects in a relatively short period of time. And it is highly likely that teachers will quickly become self-sufficient users, as was observed in this study.

b) Repositories need to hold many learning objects to provide teachers with adequate choices to select the resources they require
The Trials of Learning Objects found that, in every instance, the participating teachers would have preferred to have access to more resources than were available to them. This finding was based on the fact that teachers had particular contexts and strategies in mind as they searched for resources and frequently found items that were potentially useful but not exactly what they were seeking. In order to more fully meet the needs of the teachers, it was felt that more variety and choice would have helped them to have more easily developed the environment they were seeking. This study was conducted at an early stage of the development and implementation of the relevant repositories, which accounts for the restricted number of learning objects available to the participants.

c) Many learning objects hold strong contextual connections with their original use, which can limit their reuse in other settings
The repositories used in the Trials of Learning Objects contained many resources which were relatively easy to discover and to use in the planned setting. One interesting observation was the strong context that many of the learning objects carried, that in some ways limited their opportunities for reuse. The mathematics learning objects, for example, were designed for use in the building industry. Fractions were taught as measures of building materials etc. In the Trial of Learning Objects, the mathematics was being taught to meat process workers. The sorts of calculations the students needed to make in this setting related mainly to weights of food as part of processing. This meant that while the algorithmic processes for working with fractions were dealt with, the context would have appeared a little strange to the learners. The development of learning objects needs to consider reuse, so that wherever possible decisions are taken that can support this aim.

d) The use of learning objects appears to have a strong fit with teachers' existing design and development strategies.
In the Trial of Learning Objects, the instructional design and development processes employed by the teachers appeared to be well supported by the use of learning objects. In most instances, teachers examined the competencies they were to deliver and went into the repositories to discover what resources might be available. In such instances, the available resources became the basis of the learning settings developed. With one team, the design of the learning environment was planned first and then resources were taken from the repositories that could support these outcomes. These different approaches resulted in quite different forms of learning setting but in both cases the use of learning objects was found to be a beneficial and positive addition to the processes of the teachers. It did not appear that to use learning objects teachers needed to adopt alternative or unfamiliar design processes.

e) The use of learning objects can discourage the use of task-oriented learning designs
Following on from the previous observation, it appeared through the Trials of Learning Objects that when teachers used learning objects in their design and development, they tended to be constrained by what resources they could discover and access. As such, the process tended to result in learning settings which revolved around objects as the principal learning elements. The preferable and more effective forms of

learning environments are those where learners undertake tasks and activities with resources as supports and scaffolds (rather than as learning agents). It appeared when the teachers did not have a deliberate learning strategy in mind, the availability of learning objects drew them towards the more directed and structured learning setting characteristic of information and content as an end in themselves rather than as items that learners learn to apply and use.

f) The majority of available learning objects tend to be of a tutorial form. There appear to be far fewer content and information learning objects from which teachers can choose
In this project, all teachers came to the repositories to seek learning objects that could support online learning in units with established objectives and learning outcomes. In searching the repositories, it was evident that the vast majority of learning objects were of a tutorial nature, in that they provided information and learning activities to consolidate knowledge and skill acquisition. The teachers were unable to source information and content alone for their units and this influenced the forms of learning design that they ultimately chose to use. It was felt that access to learning objects which could provide information alone about underpinning knowledge and concepts would have been very useful to designing effective learning settings.

g) The granularity of learning objects can influence their capacity for reuse. Larger objects tend to be less useful than smaller objects
In many instances in the Trials of Learning Objects, resources were discovered that strongly supported the planned learning outcomes. But in many of these instances, the grain size of the learning object meant that there was a high degree of other material in the learning objects that teachers did not necessarily want or need. Teachers remarked on a number of occasions that they would have liked to be able to have chosen parts of the learning objects rather than having to take the complete entity. This comment was also made by several students who recognised that, within the learning environment, they were being exposed to and required to use resources that were unnecessary and in some cases irrelevant. The problem exists in the grain size of the objects and their capacity to be further disaggregated. Often disaggregation is not possible without losing critical elements. The key to success is in the careful and deliberate design to ensure grain size is optimal to support reuse. Had more time been available to the participants in this study, they may have learned to use The Learning Edge to create content modules using learning objects, and, in this way, been able to achieve more customisation to meet their students' contexts.

h) Teachers do not appear to be inclined to seek to customise learning objects
There were few teachers in the trials who customised some of the learning objects they were using. This appeared to stem from a number of reasons. In the first instance few teachers appeared to have the technical capability to use the development tools to effect the changes that might be made. Secondly few teachers had the time needed to make any changes and, thirdly, the software assembling tools being used did not easily support customisation. If we know that teachers are not likely to want to, or be able to, make changes, it suggests that in the design of learning objects, developers need to consider ways to maximise the reuse potential in instances when changes and customisation are not likely to be possible.

i) Teachers would be advantaged by better descriptions of learning objects to aid their discovery and selection
Many of the teachers commented that the time taken to discover and access learning objects was increased significantly by the time it took to run a learning object and to review its contents. Teachers need to know precisely what is in the resources they choose for their students. They need to walk in the shoes of their students to ensure that the learning experience is what they want it to be. Previewing every learning object can be a time consuming process and one that limits the extent to which teachers will search and look. There exists a need for learning objects to be developed and stored in ways that might reduce the overheads of teachers seeking to use them. Possible solutions include stronger keyword and metadata descriptors, the use of detailed abstracts etc.

j) Repositories can conceal many of the learning objects that they contain
The project found that teachers took considerable time to discover and select learning objects for use in their learning settings. Whilst the various repositories had quite effective and efficient search functions, the nature of electronic storage meant that the teachers had little sense of the scope and extent of the learning objects in the repositories that may have been useful to them. It would have been helpful to the teachers to have been able to explore some summary data on repository contents to help them to know

which repositories held the most prospect for them to use and the scope and extent of learning objects appropriate to their needs.

k) The use of learning objects in designing online settings is a complex task for inexperienced users
The Trials of Learning Objects revealed that it is possible using available resources and infrastructure to develop online learning units for the VTE sector using learning objects from local repositories across a variety of discipline areas. It was also evident that the process can have many sticking points for teachers tackling the process for the first time. The problems include locating the repositories, discovering appropriate resources, being able to assemble them in a courseware management system for delivery and designing an effective learning setting with appropriate activities and assessments. It was evident that many teachers need access to appropriate training and support and would not be able to complete this process independently.

Implications for practice

The findings from this project, which sought to explore how teachers can use LOs, suggest the value of actions in the following areas if the use of LOs is to become a component of mainstream use of ICT in the Australian VTE sector. Actions are suggested in the key areas of design and development, assembling and storing and teacher use of, LOs.

The design and development of LOs

In designing and developing LOs, a number of strategies emerged as likely to maximise the opportunities for their reuse. For example, smaller objects appear to provide more opportunity for reuse than do larger ones, while objects that minimise discipline contexts can provide greater opportunities for reuse than those strongly tied to contexts. In terms of LO types, information and content LOs without any instructional elements can provide strong contexts for reuse, while LOs designed in ways that encourage and support simple and non-technical forms of customisation, will have enhanced reusability.

Assembling and storing LOs

In developing repositories and collections of LOs, the following strategies would appear to promote their usage. LOs need to be described accurately and fully with keywords that provide some sense of the scope of learning and the instructional/learning strategies involved. Repositories could aid teachers if they were able to provide some sense of the scope and extent of the resources they contain in relation to specific subject and discipline areas. The TLO found that strategies need to be adopted to source more LOs for inclusion in repositories. The strategies would need to extend to encourage organizations and individuals to share resources and to see advantage in this. There would be many benefits gained if repository projects included a contributory process that allowed teachers and designers to contribute quality assured LOs to the repositories as well as being able to use existing objects. The inclusion of a metadata maintenance program and an automated metadata implementation and validation process would ensure metadata quality and integrity for all stored LOs.

Systems to support teacher use of LOs

In considering the forms of supports needed by teachers to create online settings using LOs, the following strategies emerged as necessary to support further uptake and use. Comprehensive support strategies are needed to enable first time users to employ LOs in elearning and the uptake and use of LOs will likely be very slow if this support is not deliberately designed and provided. The training support for users of LOs needs to include strategies in both linking and/or re-packaging/customising resources. This would allow teachers and designers to take smaller parts of LOs as required. Given the increasing opportunity for using LOs, teachers would be supported greatly with access to learning design templates that support quality learning designs using LOs and successful uses of LOs by teachers in all their forms, e.g. blended learning, fully on-line etc. need to be publicised to promote this as a mainstream strategy for course and unit delivery. It would appear that targeted professional development focusing on design and customisation strategies for novices and intermediate users would be a particularly useful support strategy.

Whilst the Trials of Learning Objects was undertaken in the Australian VTE sector, the findings have relevance and application in settings beyond this context. Both the school and higher education sector in Australia make significant use of ICT and as yet are probably less advanced in their moves to apply LOs as learning and teaching resources. The findings from this study into teachers' needs and factors influencing uptake and usage should inform and guide much of the current practice across all sectors. Clearly there is need for significantly more research and inquiry across all sectors if the opportunities and advantages promised by the new technologies, in relation to reusability and sharing, are to be fully realised. The TLO has highlighted a number of areas where creative solutions are needed to overcome the difficulties and obstacles required to mainstream LOs as effective, discoverable and usable learning and teaching resources.

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How does hypermedia support learning? The role of different representational formats and varying levels of learner control for the applicability of multimedia design principles

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During recent years, hypermedia and web-based learning environments have become increasingly important in educational contexts. The advantages they offer compared to traditional learning methods (like books) include the possibility to access information in a nonlinear and self-controlled fashion. Additionally, information can be presented in different representational codes (e.g., text, pictures) and address different sensory modalities (e.g., visual, auditory). However, the question arises how these aspects should be combined to design a hypermedia environment that enables active, self-regulated and constructive learning and fosters knowledge acquisition. Our studies investigated whether well-established multimedia design principles apply to hypermedia as well. Results show that these principles cannot simply be transferred to hypermedia environments and that certain representational formats do not foster learning per se but that it is necessary to carefully look at the affordances that these representations provide for retrieval. These results will be presented and discussed with respect to their implications for the design of further studies.

Keywords: hypermedia learning environments, multimedia design principles, learner control

Introduction

Computers and the World Wide Web as media for information delivery, as well as for information search and communication, have gained significant influence during the last decade. Thinking of tertiary educational contexts, it is nearly impossible to imagine students and lecturers working without computers. One way of conveying information is through hypermedia learning environments that are characterized by offering a high amount of learner control. On the one hand, this means that learners have the option to select and combine different representational codes (e.g., text, static or dynamic visualizations) and address different sensory modalities (visual, auditory). On the other hand, they can access information in a linear as well as in a nonlinear fashion. Ideally, this navigational and representational freedom leads to active, constructive, and self-regulated as well as adaptive learning. However, such benefits can only take place if learners are willing and able to make the right decisions with regard to the contents they want to access as well as the rate and sequence for retrieving this content. Otherwise, hypermedia environments run the risk of leading to the assembly of suboptimal information diets, to disorientation and accordingly to cognitive overload. To avoid such disadvantages, it is therefore of pivotal importance to carefully design hypermedia environments. This requirement refers to the design of content of the environments as well as to the degree of learner control provided.

Designing the content of hypermedia learning environments

When starting our research, we found that there were hardly any recommendations that prescribe how to design hypermedia learning environments with respect to representational codes and sensory modalities. However, research on multimedia learning has extensively dealt with this topic and has provided a couple of multimedia design principles that specify how these different representational codes and sensory modalities should be combined to foster learning. Recent theories, such as the cognitive theory of multimedia learning (Mayer, 2001), the cognitive load theory (Sweller, 1999), and research on multiple representations (Ainsworth, 1999), recommend using multiple representations (Ainsworth, 1999; Mayer, 2001), presenting information in different modalities (Mayer, 2001), avoiding redundant information (Mayer, 2001) and taking into account individual differences (e.g., aptitude-treatment-interactions) in instructional design (Kalyuga, Ayres, Chandler, & Sweller, 2003; Mayer & Gallini, 1990). Although these principles have been empirically validated in controlled laboratory studies on multimedia learning, the question remained still open whether they can be simply transferred to hypermedia environments. In fact, there is already some initial evidence that specific multimedia-design principles, for instance the modality principle, are moderated by learner control (Tabbers, 2002).

Adaptive information utilization and optimal degrees of learner control

The high amount of learner control that hypermedia environments allow for means that they are capable of being explored in multiple ways, thus offering adaptive information utilization. However, the question arises whether learners really take advantage of this opportunity to select and combine optimal information diets in an adaptive way or whether they benefit from a more structured information presentation. It is also as yet unclear whether there are optimal levels and types of learner control for different kinds of learners and learning tasks. There is some evidence that the hypothesized advantages of a high level of learner control are valid for learners with high prior knowledge only. In this regard, Gall and Hannafin (1994) suggest that prior knowledge may guide learner-controlled behavior in that "individuals with extensive prior knowledge are better able to invoke schema-driven selections, wherein knowledge needs are accurately identified a priori and selections made accordingly. (...) Those with limited prior knowledge, on the other hand, are unable to establish information needs in advance, making their selections less schema-driven" (p. 222). In line with this reasoning, Clark and Mayer (2003) propose a learner-control principle that advises the use of high levels of learner control for learners with high prior knowledge or high metacognitive skills.

Experiments

The experiments we conducted addressed the following questions: (1) How should the different possible contents of hypermedia learning environments (e.g., different representational codes and sensory modalities) be designed and combined to foster efficient learning for different types of learners? (2) How much learner control should hypermedia environments allow for (depending on individual prerequisites) to optimize learning while avoiding cognitive overload?

Method

Participants
196 pupils from 6 German high schools participated in the study: 114 girls and 82 boys from grades 10 and 11 with an average of 16.55 years.

Materials and procedure
The learning environment the pupils worked with was a hypermedia environment on probability theory that aimed at conveying the basic principles of the domain by means of worked-out examples. Learners working with it had to acquire knowledge about four different categories of probability theory. The environment consisted of a personal data questionnaire, a short technical instruction, a pre-test to assess prior knowledge on probability theory, a domain introduction, an example-based learning phase with the eight worked-out examples, and a post-test.

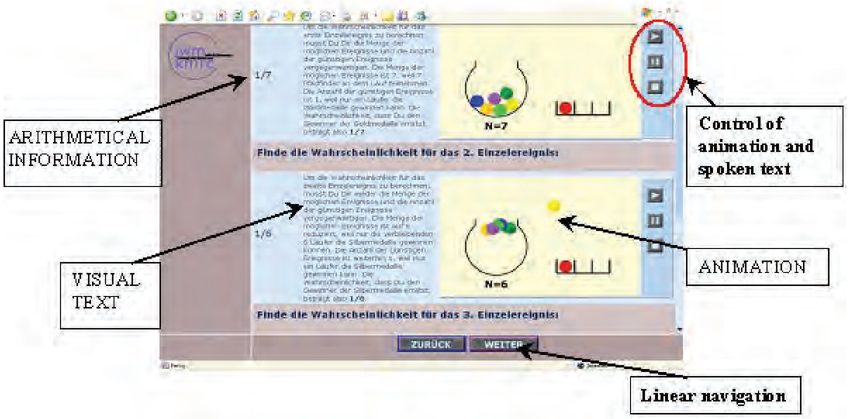
Design and dependent measures
Depending on the respective experimental conditions, different representational codes and sensory modalities were used to present the worked-out examples (Table 1). Moreover, two different levels of learner control were implemented.

Table 1: Experimental design

		Control of information presentation	
		Low level of learner control	**High level of learner control**
Presentation format	Arithmetical only	19	78
	+ written text	20	
	+ spoken text	16	
	+ written text + spoken text	20	
	+ written text + animation	25	
	+ spoken text + animation	18	

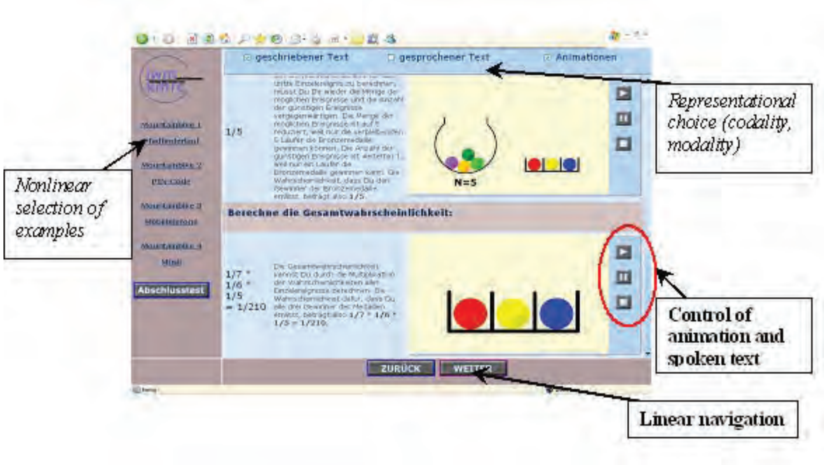
For each solution step, all experimental conditions contained arithmetical information. In the version with a low level of learner control, there were six different pre-defined formats. The "written text" presentation format provided additional visual instructional explanations of solution steps. In the "spoken text" presentation format these explanations were presented auditorily. The "written text + spoken text" presentation format contained redundant information in that it provided both types of verbal information.

In the remaining two presentation formats, written or spoken text was augmented with abstract animations. Learners who were assigned to one of these conditions could only navigate through the environment in a linear fashion by clicking the "Back" and "Next" buttons at the bottom of each page. In the condition with a high level of learner control, learners could choose the representational format by clicking the respective buttons in the upper options bar (Figures 1 and 2). They could also navigate through the environment in a nonlinear fashion by using the navigation bar on the left side of each page. Differences between the two levels of learner control therefore pertained to the selection and sequencing of worked-out examples, as well as the opportunity to choose between different representational formats, while pacing was available in all versions of the environment. Moreover, the dynamic representations were always interactive in that they were presented only on learners' demand. In all conditions (low and high levels of learner control), learners received instructions on how to retrieve the worked-out examples to make sure they were aware of the representational and navigational choices they had.



Note. Labels in capitals refer to codality and modality aspects of the environment. Labels in bold highlight control features present in both versions with low and high levels of learner control.

Figure 1: "Written text + animation" – version with a low level of learner control



Note. Labels in italics refer to the control features characteristic of the version with a high level of learner control.

Figure 2: Version with a high level of learner control

Once learners had worked through the environment at their own pace, they continued with the 44-item post-test aimed at assessing conceptual, intuitive, procedural, and situational knowledge. As dependent variables, we registered performance for the overall post-test as well as for the subcategories, learning times, and cognitive load during learning. However, due to the different amount of information provided in the experimental conditions, we expected large differences in learning times across conditions. Accordingly, using post-test performance alone as a measure for the instructional benefits of the different conditions would be grossly misleading. Thus, we calculated efficiency scores that integrated post-test performance and learning times by adapting an approach of Paas and van Merriënboer (1993). Efficiency was expressed as the difference of the performance *z*-score and the learning time *z*-score divided by the square root of 2:

$$E = (z_{\text{performance}} - z_{\text{learning time}}) / \sqrt{2}.$$

A negative score for *E* states that the relative investment of learning time exceeded the relative performance; a positive score stands for high performance scores compared to the learning time. Cognitive load was assessed with six items that assessed intrinsic (one item), extraneous (three items), germane (one item), and overall load (one item) rated on a 9-point Likert scale.

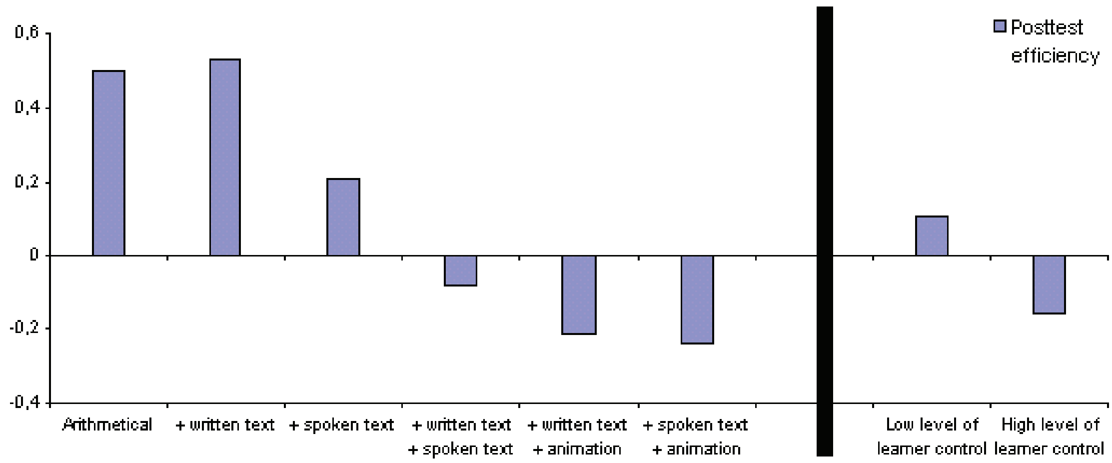
Results

Cognitive load during learning

Cognitive load was measured each time after learners had worked through one of the probability categories with two worked examples. Results showed that extraneous load did not differ across experimental conditions. Scores for intrinsic, germane and overall load were significantly higher in the "arithmetical only" than in the other conditions, where additional explanations of solution steps were provided. The latter conditions did not differ from each other regarding cognitive load. With respect to changes over time, intrinsic ($F(1,196) = 10.63$, $p < .001$) and extraneous ($F(1,196) = 19.65$, $p < .001$) load decreased significantly, while germane load ($F(1,196) = 23.92$, $p < .001$) increased significantly. These results are in line with cognitive load theory, which suggests that when extraneous and intrinsic load decrease, more working-memory capacity can be claimed by cognitive processes directly relevant for understanding, that is, germane load.

Instructional efficiency

To test the validity of the multimedia design principles, we compared the experimental conditions with a low level of learner control with regard to their instructional efficiency by means of one-way ANOVAs. The overall post-test efficiencies for these conditions can be seen in the left half of Figure 3.



Note. Due to space limitations, only overall post-test efficiencies but not efficiencies for the subcategories are depicted.

Figure 3: Efficiencies for the single experimental conditions and for low versus high levels of learner control

The *multimedia principle* was examined by comparing the "written text" with the "written text + animation" condition and the "spoken text" with the "spoken text + animation" condition. The efficiencies for "written text" were significantly higher than for "written text + animation" for all measures (overall post-test: $F(1,43) = 10.20$, $p < .01$), while there was only one significant difference in favor of "spoken text" with respect to situational knowledge ($F(1,32) = 9.91$; $p < .01$). These results clearly contradict the theory of Mayer (2001) in that they show that enriching visual or auditory text with pictures does not automatically improve performance.

The question whether *multiple representations* foster learning was addressed by aggregating the results of the "arithmetical", "written text" and "spoken text" conditions (i.e., single representations) and comparing this outcome to the aggregated results of the "written text + spoken text", "written text + animation" and "spoken text + animation" conditions (i.e., multiple representations). Learners studying single representations were consistently more efficient than learners studying multiple representations (overall post-test: $F(1,116) = 16.57$; $p < .001$). Thus, our results contradict the expectation that multiple representations foster deep conceptual understanding automatically (*cf.* Ainsworth, 1999).

The *modality principle* was examined by comparing the "written text" with the "spoken text" condition and the "written text + animation" with the "spoken text + animation" condition. The first comparison is based on the fact that the arithmetical information provided in all conditions is visual information as well. Comparing "written text" with "spoken text" revealed a marginally significant effect in favor of "written text" for conceptual ($F(1,34) = 3.52$; $p < .10$) and intuitive knowledge ($F(1,34) = 3.62$; $p < .10$). When contrasting "written text + animation" with "spoken text + animation", none of the differences were significant. These results again contradict our expectations derived from Mayer's theory (2001), who states that there should be a superiority in favor of spoken text and spoken text plus animation, respectively, because in those cases the presentation of information is distributed among a visual and an auditory processing channel.

The *redundancy principle* was examined by comparing the "written text" as well as the "spoken text" condition with the "written text + spoken text" condition. According to this principle, less material should result in better learning. Our results confirm this to a large extent, especially for the first comparison (overall post-test: $F(1,38) = 4.57$; $p < .05$). Learners receiving redundant information performed worse than learners who received less material.

In a last step, *usage of representations* was analyzed for the conditions with low levels of learner control, in which two aspects were left to learners, namely pacing and interactivity of dynamic representations. Analyzing the percentage of representations used in the different conditions revealed that learners in the three conditions with spoken text (i.e., "spoken text", "written text + spoken text" and "spoken text + animation") used the available dynamic representations to a significantly lower extent than learners in the "written text + animation" condition. Overall the dynamic representations were used only to a very small extent. Thus, they may only have provided minor affordances for retrieval within our environment.

Information utilization and optimal degree of learner control

The question which level of learner control is optimal for learners was investigated by comparing results of participants who received a high level of learner control with those who worked with low levels of learner control (*cf*. Figure 4). Conditions with a low level of learner control overall tended to be more efficient (overall post-test: $F(1,194) = 3.51$; $p < .10$). These results are in line with the argument that learners might not necessarily benefit from complete navigational freedom in that they can face problems in selecting and integrating relevant information like assembling suboptimal information diets, being disoriented and experiencing cognitive overload.

To test the assumption of Clark and Mayer (2003) who suggest that a high level of learner control might work for learners with high prior knowledge only, we analyzed efficiency scores by means of a 2*2 ANOVA with degree of learner control (low/high) and prior knowledge (low/high) as between-subjects factors. This revealed a main effect for prior knowledge in that high-prior-knowledge learners were significantly more efficient than low-prior-knowledge learners ($F(1,194) = 27.83$; $p < .001$). However, the expected interaction failed to reach statistical significance ($F(1,194) = 1.01$; $p > .30$). Thus, contrary to the learner-control principle advocated by Clark and Mayer (2003), low levels of learner control seem to be advisable for all learners irrespective of their prior knowledge level.

To investigate whether students' *patterns of information utilization* can be used to distinguish different subgroups of learners, we conducted a cluster analysis. Four clusters of students could be extracted. Cluster 1 spent more time on playing dynamic representations than any other cluster; this time was used almost exclusively for a combination of spoken text and animation. Cluster 2 spent a medium amount of time on processing dynamic representations, which was also almost completely used for playing the integrated format. Cluster 3 used the dynamic representations very rarely. Cluster 4 differed from the other three in that they mostly used the animations only and not the integrated format; this usage, however, was also restricted to a rather medium frequency of retrieving animations. The other three groups, on the contrary, did not study examples in the animations-only presentation format at all. Interestingly, all four groups refrained from studying examples presented in a spoken-text only format.

Overall, similarly to the learners in the conditions with a low level of learner control, participants with a high level of learner control did not make much use of their navigational freedom and their freedom of representational choices. Besides the aforementioned lack of usage of representations, they also did not browse through the environment in a nonlinear fashion. Rather, they just clicked on the "Next" buttons once they had worked through a page. This also raises the question of how much affordance the bars for the nonlinear selection of examples and for the choice of representational formats have provided.

Discussion and conclusions

The results of the two studies reported were surprising in that they could confirm only one of the multimedia-design principles stated by Mayer (2001), namely the redundancy principle. Contrary to expectations that can be derived from the multimedia and modality principles, conditions with single representations yielded better results and were more efficient than multiple representations. Additionally, learners in the "spoken text + animation" condition, who should have been superior to learners in all other conditions sensu Mayer, even showed the lowest performance. What could have caused these unexpected findings?

Concerning the *modality principle,* we did not find performance improvements when distributing information among different sensory modalities. This is in contrast to Mayer and colleagues but in line with findings by Baggett and Ehrenfeucht (1983) or Tabbers (2002). They demonstrated that, when there was sufficient time to read the written materials, written text yielded either equal or even superior performance compared to spoken text. These aspects apply to our learning environment (e.g., our learners were given the opportunity to read the written explanations before retrieving the animation) and may have caused these results. To test whether the modality principle holds true for environments where there are time restrictions, we have been conducting a follow-up study using the "Written text + animation" and "Spoken text + animation" conditions from the learning environment; however, these conditions were administered strictly system controlled to learners this time. They could not choose whether they wanted to play the respective animation or sound file, and animation or sound started as soon as the text appeared on the screen. Participants were 39 university students. We are currently evaluating these data and will be able to report on them at the conference.

As for the *multimedia principle*, our results showed that enriching verbal instructions with animations did not improve performance. While these findings contradict Mayer and colleagues, they are in line with authors like Tversky, Bauer Morrison, and Betrancourt (2002), who claim that dynamic pictorial representations should be carefully designed in order to be more efficient for learning than static pictures or purely textual representations. Results from Schuh, Gerjets and Scheiter (2005) suggest that so called hybrid animations, which first show the transition between concrete and abstract representations and which, secondly, show the relation between symbolic expressions (e.g., text, mathematical formulas) and their pictorial representations might be better suited to convey problem-solving skills than purely abstract or concrete animations. The question arises whether the abstract animations used in the reported studies can be improved by first showing the transition between a concrete problem statement and an abstract mathematical solution procedure and by explicitly mapping symbolic expressions onto pictorial representations (e.g., a connecting line between a fraction and its representation in the animation). Explicitly showing these relations may provide affordances for learners to think about them more deeply and may thus aid learning, whereas there might have been a lack of affordances of the current material to relate pictorial and symbolic representations.

A third issue to be discussed refers to the *learner control* provided in our studies. The initial hypothesis was that learners (at least those with high prior knowledge) might benefit from a high level of learner control in that they can adapt the information presented to their needs. However, our studies showed that dynamic representations were rarely used and that learner control did not interact with prior knowledge. There are at least three possible reasons for this finding. First, the representations might not have had high affordances, because they were not designed in an optimal way. Secondly, students might have been overwhelmed by the amount of information given at the beginning of the learning phase, which could have increased their extraneous load. According to this interpretation, it may be more beneficial to expose them to more materials only after they have had more experience with domain and instructional setting. A third explanation for the lack of benefits of a high level of learner control is that students generally do not engage in suitable information utilization strategies themselves (Gerjets et al., 2000), but rather need to be prompted to use external representations (Gerjets, Scheiter & Schuh, 2005). It seems thus advisable to incorporate instructional guidance in hypermedia environments, even for learners with high prior knowledge.

Taken together, even though we could not confirm the transferability of multimedia design principles for hypermedia, future research in this area is needed. Such research should take into account: (a) time restrictions when retrieving instructional materials, (b) a comparison of differently designed animations (e.g., symbolic versus iconic versus hybrid animations) and (c) improving the affordances of representational and navigational choices especially in conditions with high levels of learner control.

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Online student portfolios for demonstration of engineering graduate attributes

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Engineers Australia is the Australian professional body that accredits undergraduate engineering programs. It espouses an 'outcomes-based' program accreditation philosophy, but imposes mandatory 'process' requirements for off-campus programs that are in addition to the requirements for conventional on-campus programs. The focus on off-campus engineering study raises the question: how can learning outcomes, regardless of mode of study, be effectively measured? The current answer appears to be 'graduate attributes'. The literature reveals a range of sophistication in approach to graduate attributes from identifying desirable graduate attributes, through to evidence-based certification of individual student attainment of graduate attributes. Many engineering accrediting bodies around the world identify student portfolios as a strategy for demonstrating student attainment of graduate attributes. The increasing use of online technology by students and educators alike, including as part of assessment, means that many of the reported applications of student portfolios are online portfolios. The effectiveness of online student portfolios will depend on them being embedded in day-to-day educational practice, rather than being an optional extra given a low priority by busy students. This paper presents a survey of the related literature and briefly outlines a project in progress at Deakin University to trial an online student portfolio.

Keywords: graduate attributes, student portfolios, online portfolios

Introduction – engineers' learning

In engineering, off-campus/distance study is an essential element of access to education for those in remote locations and/or seeking to upgrade their qualifications whilst employed. Internationally, engineering education accrediting bodies have moved toward outcomes-based assessment of graduate competency, but are still grappling with off-campus education. In Australia, the program accrediting body, Engineers Australia, espouses an outcomes-based approach to accreditation, but prescriptively enforces minimum mandatory residential attendance periods for students studying in the off-campus mode. The 'problem' for accreditation of higher education caused by distance education, and the inability of accreditation systems based on traditional on-campus study models to appropriately address off-campus study without stifling innovation, have been reported for many years, both in higher education generally (Eaton, 2003; Haug, 2003), and specifically in engineering undergraduate education (Bourne, Harris, & Mayadas, 2005; Daniels & Rubin, 1998; Ljoså, 1995). Both national (Carnevale, 2002) and international (Taylor, 2004) engineering accrediting bodies are struggling to make progress on the issue of accrediting off-campus study, in part due to the fact that they are still having difficulty accrediting aspects of on-campus programs (Carnevale, 2002).

It is often claimed that engineering is a special case because of the significant laboratory work component. However, there are many options for off-campus delivery (Trevelyan, 2003) demonstrating no significant difference in learning outcomes (Lemckert & Florance, 1996; Watson et al., 2004). There are some skills, such a group/team work, problem-based learning and leadership that have traditionally required proximal interaction between students. However, there also exist a range of distance education strategies for these (Aravinthan & Fahey, 2004; Brodie & Porter, 2004; Freeman, 2002). In fact, not only does the literature suggest 'no significant difference' in outcomes between on- and off-campus education, it is suggested that many traditional forms of on-campus education are not effective learning environments, with a majority of on-campus student learning occurring outside of formal class time

(Chandler, Fontenot, Hagler, & Marcy, 1999; Davies, Cover, Lawrence-Fowler, & Guzdial, 2001). Additionally, it is observed that the boundaries between on- and off-campus study are now significantly blurred, with many on-campus students making use of any available off-campus learning resources to enhance their learning and/or reduce their reliance on attendance at formal classes (Chandler et al., 1999; McInnis & Hartley, 2002), and developments in distance education can lead to transformations in on-campus teaching (Subic & Maconachie, 2004). In engineering, a focus on measuring the learning outcomes of distance education has also thrown the spotlight back on the effectiveness of measurement of learning outcomes for traditional education (Eaton, 2002). 'No significant difference' (Russell, 1999) doesn't absolve off-campus studies of the need to demonstrate effectiveness, but poses the question, how can learning outcomes, regardless of mode of study, be effectively measured? The current answer appears to be 'graduate attributes'.

Graduate attributes

Arising from the push in higher education for quality assurance, accountability for outcomes and capability of graduates (Leathwood & Phillips, 2000), specifying a list of qualities or capabilities that graduates will attain provides a benchmark against which the performance of a higher education institution can be measured. In engineering, the idea of specifying required student outcomes in terms of graduate attributes has been embraced internationally for some years (Jolly, 2001; Lister & Nouwens, 2004), including in Australia (Engineers Australia, 2005), the USA (Engineering Accreditation Commission, 2003), and the UK (The Engineering Professors Council, 2000). The theory and practice of graduate attributes in engineering education remains a current research topic; in 2005 the University of Sydney offered a PhD scholarship to research a range of issues relating to undergraduate engineering graduate attributes (University of Sydney School of Aerospace Mechanical and Mechatronic Engineering, 2005).

Graduate attributes are typically expressed in terms of: a) discipline-specific attributes that relate to the particular program(s) the student is studying; and b) generic attributes that are common to all or most graduates. There is some suggestion that it is the generic attributes that are the most important (Hager, Holland, & Beckett, 2002), perhaps because the discipline specific body of knowledge is prone to obsolescence and will require continual renewal, and, in the longer term, as graduates progress in their careers, they will become less involved in the details of their discipline, and more reliant on their generic skills. While there are examples in the literature of efforts to compile lists of graduate attributes for engineering (Scott & Yates, 2002), in reality, Australian undergraduate engineering programs have no shortage of direction in this regard, as Engineers Australia identifies the graduate attributes it expects to find in an accredited program, and the hosting institution almost certainly has its own list of graduate attributes it aims to develop in its students.

In the literature related to graduate attributes, there can be observed varying levels of sophistication in approach. The range includes:

- identifying and prioritising desirable graduate attributes (Scott & Yates, 2002)
- identifying where and at what level in the curriculum attributes should be covered (Atrens, Truss, Dahl, Schaffer, & St John, 2004; Chapman, 2004)
- designing assessment to explicitly measure graduate attributes (Yeo, 2004)
- evaluation of the effectiveness of delivery of graduate attributes (Bullen, Waters, Bullen, & de la Barra, 2004), and
- evidence-based certification of attainment of graduate attributes (Williams & Sher, 2004).

As noted previously, for engineering, the applicable graduate attributes have already been specified, at least in the general sense. They may need to be interpreted into more meaningful specifications for particular engineering disciplines (Falk et al., 2002; Leathwood & Phillips, 2000). In Australia, Engineers Australia goes no further than a single list of generic graduate attributes for all undergraduate students. In the USA, the Accreditation Board for Engineering and Technology (ABET) provides general criteria, as well as specific program criteria for each of the engineering disciplines it accredits. In the UK, the Engineering Professors Council (EPC) provides generic requirements and more detailed 'exemplar benchmarks' for four engineering disciplines.

Once the list of appropriate graduate attributes has been agreed upon, there is a need to consider where in the program/curriculum the various attributes will be addressed. This is because: a) no single element of a program could hope to be responsible for more than a small part of the total graduate attribute formation; and b) each attribute will, typically, involve staged development across the program, increasing in depth and sophistication as the student progresses through their studies (Hager et al., 2002). How attributes are developed in each unit of study and how they are addressed by the entire program of study, though obviously related, are not the same thing (Curtin University of Technology Learning Support Network, 2004). Implementing graduate attributes in a program of study is a complex process, and there must be coordination in curriculum design to ensure adequate coverage of the required attributes (Jolly, 2001). The common, core units in a program of study carry a particular burden in the coverage of graduate attributes, and the use of elective or optional units for sole exposure to particular attributes should be avoided (Yeo, 2004).

The appropriate manner in which student attainment of a desired attribute should be assessed and reported remains an active question, including in engineering education (EPC Assessment Working Group, 2002; University of Sydney School of Aerospace Mechanical and Mechatronic Engineering, 2005; Volkwein, Lattuca, Terenzini, Strauss, & Sukhbaatar, 2004). Students may want a single normative mark that allows them to easily compare their performance with their peers, while employers may wish to see the level of student attainment of attributes measured against some identified criterion (Cummings, 1998). There exists a significant literature on approaches to assessing various attributes (Bowden, Hart, King, Trigwell, & Watts, 2000a, 2000b, 2000c, 2000d; Bullen et al., 2004; Deakin University, 2003; Felder & Brent, 2003; Graduate Attributes Sub Group, 2002; Sharp & Sparrow, 2002; Toohey, 2002), but these generally provide only illustrative strategies for assessment, and do not consider levels or grades of competency. Systems of grading of student competency for graduate attributes do exist, including:

- four levels of demonstrated learning/performance (information, knowledge/comprehension, application and analysis, and wisdom/problem solving) (D. Campbell, Bunker, Hoffman, & Iyer, 2004; Christy & Lima, 1998)
- development of rubrics that include descriptions of levels of student competence for each attribute, for use by staff (Kellog, 1999) and students (Williams & Sher, 2004), and
- a complex system based on Hauebstein's conceptual framework for educational objectives that includes five categories of competence in each of four domains (cognitive, psychomotor, affective and behavioural) (Holzl, 2000).

There is guidance available from those who have travelled down the road of embedding graduate attributes in undergraduate programs. Lohman (1999) suggests that the four 'essential elements' for ABET engineering program evaluation are:

1. a concise statement of the purpose of a degree program and its general educational objectives
2. a list of the principal expected outcomes to be achieved by graduates
3. a list of methods used to assess student achievement of the expected outcomes, and
4. a description of the process used to systematically document the use of assessment results.

Lohman (1999) also offers 'seven suggestions' to those developing outcomes-based assessment in engineering:

1. focus first on what is important to your institution; focus second on what is important to external constituents
2. improve first existing assessment measures and processes
3. share information and collaborate as much as possible
4. clarify terminology and establish key elements of the assessment plans early in the development process
5. identify benchmark institutions and key constituents
6. gather data and lots of it, and
7. develop a system to document the use of results.

Designing a program curriculum to expose students to a range of graduate attributes is a necessary step, but, in itself, it does not ensure that students have developed the desired attributes. One element of such an assurance is including assessment tasks that seek to measure the student's attainment of the desired attribute(s). Of course, it is often possible for a student to complete a unit of study by attaining the minimum pass mark, but not actually cover a particular attribute. A 'pass student' may progress through their entire program and successfully complete their studies, having avoided a range of graduate attributes that were designed into the curriculum and dutifully assessed (Ferguson, 2001). It is important to make the distinction between processes which ensure that a program will contain opportunities for students to learn and practice desired attributes, and processes which seek to certify actual student attainment of graduate attributes. Student portfolios are one means by which individual attainment of graduate attributes can be assessed.

Student portfolios – a possible technological solution

All three of the undergraduate engineering accrediting bodies in Australia (Engineers Australia, 2005), the USA (Christy & Lima, 1998; Rogers & Williams, 1998) and the UK (EPC Assessment Working Group, 2002) identify student portfolios as one possible strategy for demonstrating program outcomes and student attainment of graduate attributes. Love & Trudi (2004) summarise the benefits of portfolios as follows:

- they can contain many different types of evidence
- they resolve many types of assessment problems in equity and moderation
- they provide a richer picture of students' learning and competency
- students are actively involved in the building of the portfolio
- they are well suited to authentic learning environments
- they can be used in a wide range of contexts, and
- they provide a means for students to manage their own professional development.

Importantly, for the task of assessing outcomes of an entire program of study, a portfolio can act as an integrator, bringing together and assessing the whole program (Manson, Pegler, & Weller, 2004), including allowing students to demonstrate attainment of particular attributes that may not have been explicitly summatively assessed at any point during their studies (EPC Assessment Working Group, 2002). Student portfolios can be designed for multiple uses, including assessment of student attainment of attributes (Rogers & Williams, 1998), assessment of the effectiveness of institutional programs in delivering graduate attributes (Heinricher et al., 2002; Johnson, Gerstenfeld, & Zeng, 2002), and other uses for a wide range of stakeholder groups (Love & Trudi, 2004). Portfolios can help students engage more actively with, and take more personal responsibility for, their studies and assessment (Christy & Lima, 1998; Heinricher et al., 2002), and provide a focus for student reflection on their studies and development (Ferguson, 2001; Pelliccione, Dixon, & Giddings, 2005; Rogers & Williams, 1998; Toohey, 2002).

It has been found that the portfolio requirements and the structure/format in which portfolio items must be submitted need to be designed around the intended use of the portfolio, and made clear to students who will be using the portfolio (Allan, Zylinski, Temple, Hislop, & Gray, 2003; Heinricher et al., 2002). Additional effort in compiling the portfolio can be minimised by basing it around assessment items/artefacts already currently produced by students (Falk et al., 2002; Heinricher et al., 2002; Lohmann, 1999). Of course, this approach can only be employed if the assessment tasks undertaken by students clearly relate to the assessment of attainment of the required graduate attributes. It is well known that students take a strategic approach to study, and the learning activities they engage most fully with are those most clearly associated with what will be assessed (James, McInnis, & Devlin, 2002). Not surprisingly, it has been observed that attaching assessment credit (marks) to the completion of portfolio tasks is an effective motivator for student engagement (Christy & Lima, 1998; Heinricher et al., 2002; Toohey, 2002). Others reporting the use of student portfolios for the assessment of outcomes in engineering education include (Cummings, 1998), (Plumb & Scott, 2000) and (Sharp & Sparrow, 2002).

The effective use of a student portfolio as a tool for evidence-based demonstration of attainment of graduate attributes assumes that the portfolio is part of an integrated curriculum design process (Christy & Lima, 1998; Lister & Nouwens, 2004; Love & Trudi, 2004) that encompasses: a) identification and articulation of required graduate attributes; b) sequencing the staged development of these attributes across the duration of the program; c) developing assessment tasks to authentically measure the attainment of the desired attributes; and d) having in place a summative assessment process to review the completed student portfolio. In a different discipline (teaching), but for the same purpose, it has been reported that a number of studies have indicated the benefits of portfolios for teacher preparation, and for addressing program accreditation requirements (Tran, Baker, & Pensavalle, 2005/2006).

While student portfolios are often presented as the panacea for a multitude of educational ills, a range of authors have noted possible issues with the use of portfolios: the term 'portfolio' has a multitude of meanings; portfolios are used for many purposes; and the understanding of, and approach to, assessment employed by the assessor(s) are likely to influence student learning as much as any particular assessment vehicle (Godinho & Wilson, 2005). Portfolios provide 'discernible traces of performance', as distinct from the actual performance of a skill or the application of specific knowledge, hence, their contents are open to interpretation by assessors (Hay & Moss, 2005). In the context of the assessment of professional standards and professional accreditation of teachers (a scenario not dissimilar to the assessment of student attainment of attributes required for graduate membership of the engineering profession), it has been noted that portfolios structured around tightly specified professional criteria may lead to a conformity of outcomes that is not in the best interests of students or the profession (Ferguson, 2005). We need to be aware that simply changing the assessment format does not absolve us of the need to critically consider the purposes of assessment, what will be assessed, who will perform the assessment, and the criteria that will be employed in assessment.

While it is possible to employ a paper- or hardcopy-based student portfolio, the increasing use of online technology by students and educators alike, including in assessment, means that many of the reported applications of student portfolios are online portfolios (or, e-portfolios) (Dixon, Dixon, & Pelliccione, 2005; Love & Trudi, 2004; University of Sydney Faculty of Science, 2004; Williams & Sher, 2004). Rogers & Williams (1998) suggest that the benefits of online portfolios include:

- ease of use
- gives students secure control of their portfolio
- a multimedia archive of the material can be produced
- the portfolio contents can be searched
- materials can be easily updated and replaced
- students and staff can access the portfolio online, anytime
- portfolio marks can be automatically logged and managed
- students can be provided with feedback online, and
- the portfolio structure can be aligned with the required graduate attributes, so that student submissions are focused on the outcomes to be measured.

In an engineering education context, reporting on the development of the 'Polaris' online portfolio system (Campbell & Schmidt, 2005), the authors noted that electronic portfolios are emerging in many disciplines, and while their reported use in engineering has been limited, it is also on the increase, with documented applications in parts of a study unit, the whole of a study unit and the whole of a program. They further note that:

- much of the work now produced by engineering students is 'electronic' in nature, hence, well suited to an online portfolio system
- a portfolio system can feature multiple examples of work and can show student development over time
- student portfolios are likely to become an important part of the recruitment process
- there is a need to strike a balance in the structure of the portfolio system between the mandatory criteria required as evidence (with the consequence of all portfolios looking identical), and giving students some freedom of expression in the content and appearance of their portfolios
- the portfolio system is a means to engage students in exercises to help them understand their developing professional skills, and, by its nature, creating a portfolio is a reflective exercise, helping students to self-assess their performance and to reflect on the 'whys' of their program
- providing an area in the portfolio for reflective journaling is crucial, and the Polaris system includes reflective questions to help students create descriptions of the work they deposit

- a student portfolio system has many benefits for an academic institution, including the collection of accreditation materials, and
- while the Polaris system has been optional for students to use, the level of use by students has grown strongly over a number of years.

In addition to any pedagogical or professional issues, the introduction of technology in education typically creates a range of technological and staff and student development issues. There are a range of possible technological solutions for implementing an online portfolio system that need to be considered, including commercial/proprietary systems, open source/public systems and in-house/custom developed systems. It is noted that a key technological issue with most online portfolio systems is storage capacity – the typical file space limitations of most systems may limit the number and types of media files uploaded by students (education.au limited, 2005). For example, a student video of a few minutes duration may result in a file of tens of megabytes in size, which will be impractical to upload into an electronic portfolio system (and later on, to view) without broadband Internet access. Once technological issues are overcome, user issues may arise. Students need to learn how to use the portfolio system. One approach is to employ the portfolio system in a foundation study unit to develop technological competency for all commencing students, relieving academic staff from having to teach this in later study units (Tran et al., 2005/2006). A automated step-by-step or 'wizard' input process can be provided for students to configure/initialise their portfolio, and a structured question process can be provided for students to upload and reflect on their work (M. I. Campbell & Schmidt, 2005). Academic staff also need to learn how to use the system. On-going use of the system by academic staff can be expedited if the system embodies a database structure and/or workflow process based on the relevant graduate attribute standards, type of learning activities employed, required evidence of student learning and other performance expectations of assessment (Tran et al., 2005/2006). As with most applications of technology in teaching and learning, the effectiveness of online student portfolios will depend on them being embedded in day-to-day educational practice – design of curriculum and syllabus, development of study materials, conduct of teaching and learning, and assessment – rather than being an optional add-on, likely to be given a low priority by busy students with many demands competing for their time (education.au limited, 2005).

Online student portfolio trial at Deakin University

A trial of an online student portfolio for the documentation of student attainment of graduate attributes in the undergraduate engineering program is currently in progress at Deakin University. Based on the required graduate attributes of both Engineers Australia and Deakin University, and using the direction found in the literature, a sub-set of five attributes have been chosen for the trial. The trial has been embedded in a final-year study unit that addresses professional practice issues. Students are asked to deposit 'evidence' (written work, presentations, computer programs, audio recordings, videos, photographs, etc.) of, and reflection on, their attainment/understanding/development of the specified graduate attributes. The online portfolio submissions have marks assigned to encourage completion of the assessment task.

While the trial is still a work in progress, an initial student questionnaire was administered to establish the students' initial understanding of graduate attributes and student portfolios. The response rate was 60.8 %, and there was no significant difference between the class population and the respondent sample group in the demographic dimensions of gender, mode of study and course of study. While more than half (52.1 %) of respondents were aware that Engineers Australia specifies required graduate attributes, only one third were aware that Deakin University does the same. One third of students did not appreciate the link between study and assessment, and the development of graduate attributes. Exposure to student portfolios was low; less than half (43.8 %) of respondents understood the purpose of a student portfolio, and prior use of student portfolios was reported by less than one in six (14.6 %) respondents. It is likely that students encountering a student portfolio for the first time will require proper orientation to understand the purpose and operation of any portfolio system. Generally, the results from the initial questionnaire, while interesting, will primarily form a baseline reference point for comparison with the end of semester follow-up questionnaire results.

Conclusion

There is little doubt that graduate attributes will continue to be a focus generally in higher education, and certainly in engineering education. If accreditation of undergraduate engineering programs is genuinely outcomes-focused, then, accreditation systems should be based on graduate attributes that are able to be articulated/specified, that are tangibly demonstrable, and that are open to delivery by range of processes/modes. There will almost certainly be a move toward certification of individual student attainment of graduate attributes, rather than simply certifying that programs of study provide opportunities for students to participate in activities designed to develop particular graduate attributes. Certification of individual student attainment of graduate attributes may provide the reassurance that professional accrediting bodies need to genuinely focus on student and program outcomes, rather than retaining prescriptive process requirements depending on the mode of study.

Student portfolios are one means for collecting artefacts, performances, reflections and other evidence to document student attainment of graduate attributes. Given the growing influence of online learning environments, coupled with the fact that much student work is now electronically generated, it is likely that online portfolios (e-portfolios) will play an increasing role in the graduate attributes arena. As with any application of technology in teaching and learning, pedagogical issues will be coupled with issues of technology and user development. Portfolios, electronic or otherwise, are a vehicle for student assessment, and while offering new possibilities in sophistication, do not absolve academics from fundamental considerations of the purposes of assessment and the strategic role assessment plays in guiding student study and learning.

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Mediated electronic discourse and computational linguistic analysis: Improving learning through choice of effective communication methods

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The author conducted research on the ways in which electronic mail, forums and chats are used within an online distance, open and virtual learning environment (WebCT) at a French University, for both on and off-campus students. This article briefly describes research on how computational linguistic analyses help us understand language evolution in the context of higher/further education and research. Results may lead teachers and tutors to choose more effective communication methods, thereby improving overall learning.

Keywords: mediated electronic discourse, computer-mediated communication (CMC), computational linguistics, virtual-learning environments (VLE)

Introduction

We have conducted research on computer-mediated communication (henceforth CMC) within a French University (Université Paul-Valéry, Montpellier 3) since 1996. Discourse appearing in email messages, forums (i.e. asynchronous discussion groups within a closed VLE) and chat sessions seems to be shaped in a particular way, precisely because one uses a computer. The computer becomes a tool, a sort of mediator, indirectly modifying the discourse within a CMC environment. A new discourse 'genre' which we call *mediated electronic discourse* (henceforth MED) is created. Others refer to Netspeak, Weblish, Cyberspeak (Crystal, 2001), oral-written hybrid forms (Anis, 1999), computer-mediated communication (Herring, 1996), electronic communication (Anis, de Fornel & Fraenkel, 2004), new forms of written communication (Guimier de Neef & Véronis, 2004, 2006). In this paper, after specifying several main features related to MED, we describe how computational linguistic tools help to perceive language evolution in the context of further/higher education and research. Although our research is conducted entirely on the French language, we believe that computational linguistic techniques are readily applicable to other languages (Herring, 1996). Using results from these analyses may serve as a guide for deciding which communication methods to use in particular pedagogical contexts, thereby influencing overall learning.

Mediated electronic discourse

In several articles (Panckhurst 1999; Panckhurst & Bouguerra 2003), we posit that MED is similar to oral forms for some aspects and similar to written forms for other aspects, and that in other cases, features may appear to be MED-specific. In this brief paper, our interest lies with the types of language evolution appearing within a CMC environment, whether related to written or oral forms or neither.
Some of the main features of MED are listed below (Panckhurst, 2006a for more detail):

- *smileys* to introduce non-verbal semiological aspects, specific typography, words in uppercase, lengthening or repetition of letters, (which, in certain cases may simulate intonation, and therefore indicate some paraverbal information), marks such as '>'or '|' (indicating a repetition of discourse between sender and recipient);
- spelling, grammatical mistakes and absence (or reduction) of punctuation (Panckhurst, 1998; Véronis & Guimier de Neef, 2006);
- neology or neography (Véronis & Guimier de Neef, in Sabah, 2006), for instance, SMS abbreviations or words borrowed from foreign languages.

More linguistic features include:

- predominant usage of the present tense (often over 60-70%) as opposed to imperfect/past, future, conditional, imperative;

- high usage of first person deictic pronouns (as compared to second and third person pronouns);
- lower percentage of verbs (under 20%) compared to other written forms (over 20-25%), and among verbs used, frequent usage of modals (between 20 and 30% of overall verb usage);
- increased usage of ellipsis (for instance: *Vous remerciant/Thanking you*; *Impossible de trouver le document à enregistrer sur disquette*/*Impossible to find the document to save on disk*)

Other more extra-linguistic aspects which are typical of online communication include:

- relational: conciseness, rapidity, anguish/worry (if a long silence is observed before responding to messages), aggressiveness, impulsiveness, an (illusionary) impression of proximity, protective barriers (no direct face-to-face contact), etc.
- communication context: reduction or absence of introductions and closures, non-observance of conversational rules (turn-taking, floor-taking, adjacency pairing, etc).

Case studies

Situation and context

Since 2001, our initial research (on MED & email) has been broadened in order to take into account forums and chat sessions, within an online distance, open and virtual learning environment (WebCT) at our University, for both on and off-campus students. Over a ten-year period, we have gathered an important amount of data (corpora totalling almost 500,000 words) and used it specifically to study email messages, forums and chat sessions (Panckhurst 1999, 2001, 2003, 2005, 2006), between students and teachers on the one hand and between student peer groups on the other hand. Students are of course informed of this and all messages are rendered anonymous before analysis. Both on-campus and distance-education students' messages are analysed with a computational linguistics tool for French morpho-syntactic analysis, Cordial (by Synapse: http://www.synapse-fr.com). In the present research, morpho-syntactic analysis is essentially used for determining syntactical categories of words (verbs, nouns, adjectives, adverbs, etc.) and for reducing ambiguity at the sentence level; this extends beyond a solely lexical/statistical/concordancing text-analysis approach in which word frequencies are indicated (see the Xerox website for an online demonstration of morpho-syntactic tools in various languages: http://www.xrce.xerox.com/competencies/content-analysis/toolhome.en.html). In the present paper, we briefly compare data from three corpora used in recent years: 1999 (solely email corpus), 2005 and 2006 (forums and chats).

Presentation of the 2006 corpus

The 2006 corpus includes forum and chat messages related to three courses: two undergraduate courses, one for off-campus students (L3E57-chat), and one for on-campus students (L3E63-forum, L3E63-chat); one off-campus Masters' course (M2-chat).

Table 1: Statistics for the 2006 corpus: dates, participants, messages

	L3E63-forum undergrad. on-campus	L3E63-chat undergrad. on-campus	L3E57-chat undergrad. off-campus	M2-chat postgrad. off-campus
Date and participants	Jan-Feb 2006 90 participants, in 3 groups	Jan-Feb 2006 90 participants, in 3 groups	Nov-Feb 2005-2006 4 participants, 2 sessions	March-April 2006 6 to 8 participants, 3 sessions
No. of messages	186 total (13 to 67 messages per group)	716 messages	432 messages	1,219 messages
Volume (no. of words)	14,934	3,836	3,220	7,573
Volume (average no. of words per message)	80.3	5.4	7.5	6.2

In Table 1 above, the average number of words per message is much lower in chat sessions (5.4 to 7.5) as compared to forums (80.3). This accords with recent corpora (2005: 47.9 to 97 words per forum message, 10.7 for chats). Variation within forum messages can depend on the nature of the pedagogical work and students' habits associated with particular communication methods; the 2005 corpus varied from 47.9 words (undergraduate students) to 97 words per message (Masters' students having used forums for a long time). However, there is always an important difference between the averages for forum messages and chat messages because of the way in which the quasi-synchronous nature of chat sessions may simulate oral communication and the fact that one types quickly in a reduced typing space.

Results and language evolution

In ten years, we have noticed a certain number of changes in language within MED, concerning linguistic issues: question and negative forms, tenses and types of verbs, deictic pronouns, syntactic categories. In this short paper we briefly describe just two issues: question/negative forms and syntactic categories.

Question and negative forms have remained traditional in French online communication (for emails and forums), i.e. either inverted question forms such as *Le partiel aura-t-il lieu ? Will the exam be held?* or those using a particle such as *est-ce que — Est-ce que vous pouvez me faire un résumé du cours?/Can you summarise the lecture for me?* appear massively and *ne* appears fairly systematically with *pas*. This is contrary to French oral communication, where intonation is often used (*Tu viens?)* and *ne* is usually eliminated (*Je sais pas*). However, in recent analysis of chat sessions, interrogatives using solely a question mark have increased remarkably. In our 2006 corpus, 41.4% of question forms used question marks, compared to only 6.1% of those appearing in forum messages. However, the chat messages usually coincide with abbreviated SMS type usage, such as *C fini ?* (*C* abbreviates *c'est — Is it finished*?), compared to more formal usage in emails and forums: *Je suis très préoccupée par la grève de ce jour, le partiel est-il toujours maintenu?/I'm very concerned about today's strike, is the exam still going to be held?* Concerning negative forms without the *ne* particle, our 2006 corpus shows only 3 to 9.1% for forums. However, in one particular instance, where students were put into peer groups without teacher intervention, this usage increased dramatically to 60.4%. Again, this automatically coincides with SMS usage: *Le truc ke g pas compris c kil fo faire un résumé/Le truc que j'ai pas compris c'est qu'il faut faire un résumé/The thing I haven't understood is that the summary is compulsory*. In French SMS, *g* replaces *j'ai* through phonetic usage, therefore writing *je n'ai* is much longer, hence the abbreviated form and elimination of *ne*.

Syntactic categories used in different communication methods have evolved remarkably since the 1999 corpus (see Figure 1).

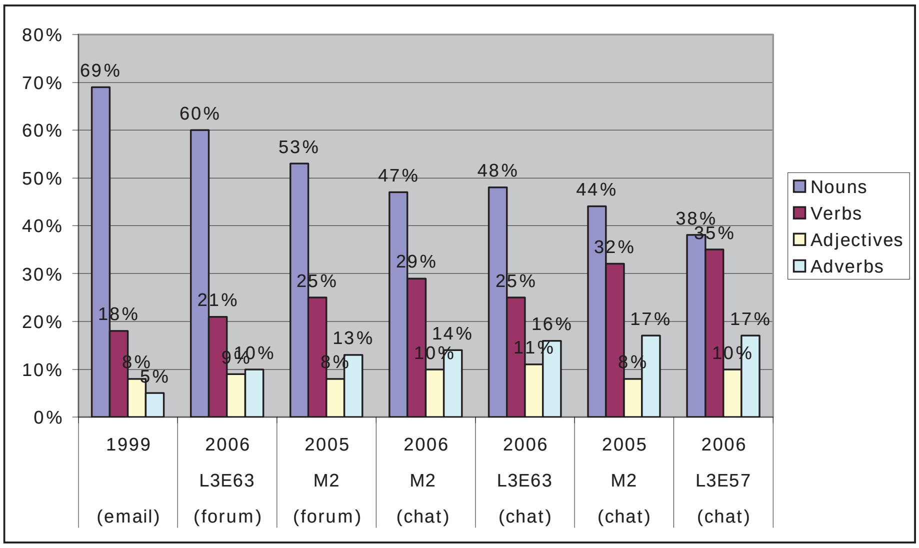

Figure 1: Syntactic categories (occurrences) used in email, forums, chats (comparison 1999-2006)

Up until 2005, our corpora showed that syntactic categories used in MED were very similar to other written forms (i.e., high usage of nouns, low number of verbs). In Panckhurst (2006b), we indicated an important change in the 2005 corpus: reduction of nouns, adjective stability, increase of verb and modal adverbs usage, but new corpora were needed to confirm this tendency. The 2006 corpus provides this confirmation and demonstrates that linguistic usage has evolved quite dramatically; the results of the analysis for syntactic categories indicate that mediated electronic discourse may be either closer to speaking or to writing, and varies according to the communication method adopted. In Figure 1, chat can be seen as the more "oral" method, whereas forums and email are closer to the "written" method.

Conclusion

Computational linguistic analysis is important in order to help us perceive certain changes. In our study using automatic analysis with Cordial, syntactic features indicate that chat sessions, which contain an overall higher percentage of verbs and adverbs and a lower percentage of nouns, may be more appropriate for oral, social communication, whereas forums and emails, which contain an overall higher percentage of nouns and a lower percentage of verbs and adverbs, may be more readily used for exchanging information (Crystal 2001). Many of our colleagues choose chat sessions (rather than forums) with distance-education students because they see them as an important tool for creating a virtual "community" instead of simply a "group" of students, as well as for maintaining links and reducing student dropout. However chat sessions are not the right tool to use in all pedagogical situations (as forums may be more appropriate in specific contexts) and teachers may not necessarily perceive this. The choice and use of communication methods needs to be thought through carefully. Choosing the right communication tool for a particular pedagogical context is important for coherent learning; linguistic analysis which demonstrates features related to various communication methods (i.e. syntactic indications highlighting oral/written, informal/formal usage, etc.) can help in making the most effective choice, but broader comparative linguistic, extra-linguistic (Panckhurst & Bouguerra, 2003) and cross-disciplinary research is necessary in order to understand more about current language and communication situations.

MED has changed over the past ten years, according to communication methods chosen and as a result of overall language evolution. In 1996, we could not have imagined that SMS-type abbreviated messages would invade communication spaces in higher/further education. Within several years, University lecturers may well receive SMS-type messages not only in chat sessions but also in forums and email; up until now, this has never been the case in our experience. More importantly, as Véronis & Guimier de Neef (2006) note, most of the linguistic phenomena in SMS messages appear simultaneously: syntactic modifications, spelling, abbreviations, phonetic incorporation, etc. They indicate examples for French, e.g. *1dpdte* (*indépendante*), including a combination of problems: numbers, vowel elimination, morphemes. The architecture of current software, which is mainly based on sequential processing will thus need to be totally redesigned in order to analyse new forms of written communication efficiently.

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A pragmatic and strategic approach to supporting staff in inclusive practices for online learning

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Changes in legislation, an emphasis on widening participation and the increasing reliance on online techniques for learning and teaching have contributed to improved opportunities for students with disabilities to participate in Higher Education. Many accessibility advocates would argue that accessibility should be the primary consideration for the development of online resources, but in the academic setting it is usually teaching staff who are largely responsible for the production of their own electronic resources. Academics may lack the time, expertise and the motivation to undertake inclusive practices. This paper explores means of supporting academic staff in the creation of accessible and inclusive online learning materials through activities designed to create an empathy with the student experience, coupled with targeted, timely and appropriate training. We go on to outline the proposals for incorporating accessibility into an institutional strategy for e-learning and proposals for further research.

Keywords: accessibility, inclusion, staff development, online learning

Introduction

At a recent accessibility forum, web accessibility advocate, Bruce Maguire, stated that when designing for the web, developers should think “accessibility first, accessibility second, and accessibility all the way down the line” (Maguire, 2004). The Special Educational Needs and Disability Act (SENDA, 2001) and Disability Standards for Education (DSFE, 2005) amendments to the Disability Discrimination Acts in the UK and Australia, requires all services, including online learning, to be accessible to students. Furthermore, SENDA requires establishments to be ‘anticipatory’ in meeting students’ needs, while the DSFE requires reasonable adjustment in consultation with students.

Online learning can be a liberating and enabling experience for disabled students. The adoption of blended learning and alternative approaches through a learning management system or a lecturer’s web site can facilitate the same independence and equality of experience as their fellow students (Pearson & Koppi, 2002). Most often academics are largely responsible for producing and maintaining their own online learning materials, with the possible exception of specialist multimedia. While some embrace the challenge of new technologies with enthusiasm and accept the need for accessibility, other over stretched academics may regard the requirement to produce accessible online courses as a burden they have neither the skills nor the time to tackle (Bennett, Hewitt, Kraithman & Britton, 2003).

The challenge then for those responsible for supporting staff is how can academics be persuaded and adequately prepared to adopt accessible and inclusive practices? Should it be an all or nothing approach? Should academics be expected to ensure that their courses are fully accessible from the outset? Accessibility first, second and accessibility all the way down the line is not the priority of staff producing e-learning materials. At best they are concerned with creating an effective learning experience for their students, or using blended learning approaches to free up time for research. Given that academics already have many demands on their time and may not regard themselves as ‘technically savvy’ it may not be appropriate to take an all or nothing approach.

Universities and in particular those responsible for staff development and support, need to combine a strategic approach to ensure academic staff receive appropriate training with institutional planning to adopt inclusive practices.

Background

Through a project spanning five years (Pearson and Koppi, 2002, 2003a, 2005), partly funded by the Higher Education Funding Council for England (HEFCE), we have researched, developed and refined a pragmatic and strategic approach to encouraging inclusive practices. The three stage approach involves:

- motivating staff by encouraging empathy with students with disabilities;
- training to develop basic skills in accessible design using the tools staff are familiar with;
- institutional planning to ensure awareness raising at all levels and access where appropriate to expert support and resources.

Courses have been developed in different modes and at different levels of intensity to meet the particular needs of the staff involved, but feedback on the early workshops indicated that participants felt overwhelmed and even less confident about their ability to adopt inclusive practices (Pearson & Koppi, 2003b). As a result, the strategy arrived at for the course development was to pare it down so that staff achieved an appreciation of the practical difficulties experienced by disabled students, followed by training in practical skills in making the most commonly used e-learning materials accessible. The courses are based on five major themes which, taken together, would enable the academic to understand, appreciate and develop skills in accessible design. These five themes encompass:

- legal obligations which can also be regarded as quality assurance requirements;
- awareness of and the ability to use available guidelines and protocols;
- some understanding of the assistive technologies used by students with disabilities;
- awareness of designing for inclusion;
- checking tools and mechanisms that are available for the designer to check the accessibility of web pages.

The extent to which each of these themes is covered depends on the mode and intensity of the course. During the workshop sessions, participants have hands-on experience in the use of assistive technologies (including speech recognition tools and screen readers); tools for checking the accessibility of web resources; and the creation of accessible documents (including PDF, PowerPoint and Word).

The staff development activities are also being combined with an institutional strategy to ensure that an integrated approach is adopted. Kelly, Phipps and Swift (2004), propose a framework for e-learning developers that adopts a four stage approach: awareness, investigation, understanding and implementation. We suggest an approach aimed specifically at teaching staff who are aware of the need for inclusivity: motivation, skills development and strategic support. The remainder of this paper examines the strategies adopted, beginning with the way that staff are motivated by creating an empathy with the disabled student experience, followed by a description of the skills development programme. Finally we discuss the way that inclusive practices in e-learning can be incorporated into a wider institutional strategy.

Motivation

The literature on the use of simulations (particularly in the field of game play and business management), suggests that they can be effective as a motivational strategy (Colella, 2000) that promotes learning. In the business context, research suggests that interactive simulations enable people to develop rules that allow them to transfer their experience to real world situations:

> Fun simulations are memorable experiences. People play and learn from them without being compelled to. A community of players spontaneously forms around the simulation. Without realizing it, they develop and internalize rules for success that they can intuitively apply in the real-world (Glass-Husain, 2005).

Empirical evidence suggests that activities simulating particular disabilities do not facilitate the development of positive attitudes towards disabled people. However, when simulation is combined with other learning methods it can result in positive perceptions toward disabled people (Herbert, 2000).

In teacher education, research shows that the use of video can be beneficial in creating a culture of shared practice and that by sharing the experiences of experts through the use of exemplary video case studies, teachers are able to make explicit associations with their own practice (Meyer, David, Cantin & Aube, 2005).

Simulations of interactive computer activities as well as video clips of an expert blind user accessing learning activities through a virtual learning environment (VLE) were used to instill some empathy for the academic with the disabled student experience, to help them to understand the problem of access, to motivate them to adopt new practices and to persuade them that it is worth the effort.

The use of interactive computer activities from WebAIM (http://www.webaim.org/simulations/) (Figure 1) and from the Disability Rights Commission (http://www.drc-gb.org/newsroom/demo.asp) that simulate the experience people with different disabilities have when accessing the web helps staff appreciate the issues. It is important to note here that these activities do not simulate the disability itself, rather the effect that it may have on a person's interactions with the computer.

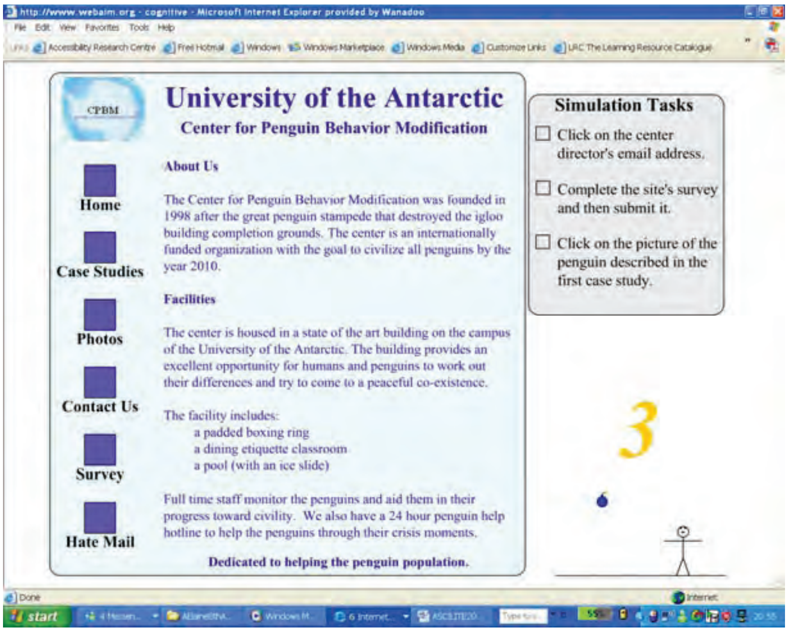

Figure 1: WebAIM distractibility simulation to illustrate the experience of cognitive disability on web access

Engaging staff with the learner experience provides motivation for engagement in making their own web materials accessible, as the following quotes illustrate:

> Having hands on experience simulating different scenarios gave very good insights. (Anonymous participant evaluation)

Viewing the student who is blind (in a recorded video) navigating through WebCT while he comments on the difficulties encountered or designs that are helpful, proved one of the most powerful and meaningful learning experiences for participants:

> The videos of the blind student and the practical work with assistive software are moving experiences for me personally. (Anonymous participant feedback)

The videos were custom produced in house and involved the blind student carrying out typical tasks within an online course including following instructions, reading and responding to messages in the discussion forum and attempting to read a paper in PDF format in preparation for answering set questions. The video shows the student carrying out these tasks in an 'inaccessible' format along with examples of how they can be made more accessible.

Evaluations confirmed the value of observing how the disabled student accessed the resources, the problems he had and the examples of how such activities can be made accessible. Typical comments included:

> Seeing how the blind student managed to get around web site and how resources can be easily re-worked to make them more accessible gave me ideas for improving my own course. (Anonymous participant feedback)

Through careful selection of appropriate interactive simulations that give the participant a perception of the disabled users experience of accessing the web, together with bespoke videos that reflect the authentic experience of disabled students the conditions are created that enable staff to empathise with the disabled student. This new understanding motivates participants to seek solutions that will make their courses more inclusive.

Skills development

Academic staff often see the need for meeting the needs of disabled students as the responsibility of the institution's disability service (Riddell, Tinklin & Wilson, 2004), yet they would regard development of their own teaching resources as largely their own responsibility. Our program includes face-to-face workshops which give participants experience in creating those documents that are most commonly used in VLEs and which academics would normally produce themselves: PowerPoint slides, Word documents and PDFs. These types of document, although most often used as teaching resources can be problematic for disabled students – particularly those with vision impairments or learning difficulties. Standard Microsoft PowerPoint slides can be a powerful teaching tool to support live presentations, to present key points as an aide memoir for students and to create handouts. Students often appreciate having access to slides on the web ahead of or after the class for preparation or revision. However, for students using screen readers, these slides are not accessible without an html version (WebAim, http://www.webaim.org/techniques/powerpoint/convert.php). Indeed slides that are content heavy or contain multimedia elements may result in large files that are difficult to download for many users; and multimedia may need other adaptations. Microsoft Word is often the originating document for other formats (such as PDF) and without the careful use of the formatting features (e.g. headings, titles, lists), inclusion of tags and descriptions, appropriate use of colour, structure, and use of language, these documents can be difficult for those with vision impairments or cognitive disabilities to access effectively (NCDAE, http://ncdae.org/tools/factsheets/word.cfm). Unless a PDF document is created from a properly prepared Word document, it is likely to be difficult or impossible to access, principally for screen reader users, those with low vision, motor disabilities or students with cognitive disabilities (WebAim, http://www.webaim.org/techniques/acrobat/). Many PDF documents found online are simply scanned from original paper documents and as such are converted to a graphic rendering them totally inaccessible to blind users.

Once teaching staff understand the reasons why students have difficulties accessing online materials, they readily engage with the hands-on activities. Staff need the opportunity to reflect and then follow up with more specific training to meet their own particular needs. Initially, many are concerned that there is just too much for them to know and be able to do. They need reassurance that they are not expected to throw away all their work (that isn't accessible) and that an incremental approach can be taken to introduce inclusive practices gradually and at a pace that suits their time and skills level.

Depending on the subject discipline, the individual students particular needs and the learning and teaching methods used, making e-learning resources accessible to all may not be practical or even desirable (Kelly, Phipps & Howell, 2005). If the tutor can make information resources and standard learning and teaching materials accessible as a first step, it will improve the learning experience and accessibility for all students. Indeed, a recent audit of learning resources available through WebCT at the University of New South Wales revealed that almost 90% of the documents were in PDF format (which is often problematic for the reasons stated above).

More complex accommodations or alternative approaches can then be negotiated with disability support officers or learning technologists. An alternative or equivalent learning experience may not always be an online one (Phipps, Witt & Kelly, 2005).

Strategic planning

The need to incorporate strategies for inclusion in an organisational strategy for e-learning was identified in Bates ACTIONS model (Bates, 1997). Bates was referring not to the need for inclusion of disabled students, but rather to the need to ensure that all faculties are encouraged and supported in their use of technology for teaching. The ACTIONS model comprises a set of criteria: Access, Costs, Teaching functions, Interaction and user-friendliness, Organisational issues, Novelty, and Speed of course development/adaptation. Bates identified these criteria as those required to be taken into consideration when choosing and using technologies and when considering the relationship between learning, teaching and organisational issues. When the legislative, pedagogical and ethical aspects of inclusion of all students is taken into account, the need to provide appropriate support to achieve accessible e-learning is even more apparent.

The third finding from the project was the need to ensure that accessibility in flexible and e-learning is included as part of the institutional strategy for incorporating disability standards in education. Reid (1999) identified challenges from system, producer and user issues in bringing about changes in relation to the use of online learning. The strategy being developed at University of New South Wales can be summarised by drawing on some of the problem areas identified by Reid:

Technical change

New tools for producing accessible courseware, for testing the accessibility of online resources and assistive technology that supports the access requirements of disabled students must be researched and kept under review for their potential in supporting staff and students.

Skills development

Much of the feedback from the online courses and workshops we have held over the last five years has highlighted the need for ongoing and targeted training. Professional development activities should include access to online self help support (e.g. the accessibility support site http://www.edtec.unsw.edu.au/inter/support/accessibility/access_frame.cfm); guidelines specifically designed to be appropriate to academics (e.g. Pearson & Koppi, 2001); training in the use of particular tools, techniques and design; and awareness raising activities.

Communication

Disability legislation as it relates to education and online learning (e.g. the SENDA, 2001 amendment to the Disability Discrimination Act in the UK), the complexity of guidelines for web based content such as those produced by the W3C WAI (http://www.w3.org/WAI/), the standards against which accessibility is sometimes measured such as Section 508 in the United States (http://www.section508.gov/), or the Disability Standards for Education in Australia (2005), is complex and sometimes esoteric. Although the W3C2.0 Guidelines (which are expected to become the de facto standard for web accessibility), are designed to be more accessible in their presentation, and include examples and illustrations, the terminology is still beyond the scope of most who are not technical professionals. Those responsible for institutional support need to monitor, translate and where necessary distill these standards and guidelines into to user-friendly language and techniques to make them relevant to and usable by academic staff.

Technical expertise

Academics need to have access to specialist services for the creation of accessible resources (for instance captioned videos or accessible resources created in Flash MX) which may be beyond the technical capabilities of staff.

IT developments

There needs to be an institutional responsibility for monitoring the accessibility support provided by the vendors of learning management systems (such as WebCT and Blackboard) and for e-learning development tools. This might include the testing and evaluation of tools that may support the development process of accessibility resources for academics.

Not all of these initiatives need to be provided specifically by each individual institution - there are organisations whose remit is to support institutions in the preparation of an accessibility strategy and to offer support at all levels of the organisation. For example, the Web Accessibility Network for Australian Universities (WANAU, http://www.wanau.org) supports staff at all levels in web accessibility, and provides a collection of resources to help in the development of strategies for online accessibility. In the UK, TechDis (http://techdis.ac.uk), which is funded by the Joint Information Systems Committee (JISC), is an educational advisory service which aims to support the enhancement of the student experience through technology. Other services offer specialised student support that focus specifically on the needs of the individual. The Macquarie Customised Accessibility services (MCAS) was set up to address the problem that students are often forced into using whatever technology support is available at a given University. MCAS, a fees-based service offered across the Australian Higher Education sector (Kerr, Burrel & Sait, 2006) aims to provide a customized solution that meets the students' individual accessibility and pedagogical needs.

Further work and conclusion

While the work here has focused on the development of e-learning resources usually delivered within a Learning Management System, there are other, complimentary areas currently being researched by the partners in this project, with the aim of using technology to improve the learning experience for students with disabilities. Specifically, research is being undertaken in making lectures accessible, inclusive learning design tools, accessible online assessment and the tools to support the creation, retrieval and re-use of adaptable learning objects. An accessible learning experience depends on flexibility in the support provided, the level and types of training for academic and support staff, and the need to recognise and accommodate wherever possible the needs and preferences of learners.

Many of the resources utilised in the online courses and hands on workshops have been very well received and participants have requested them for awareness raising activities and staff development in their own institutions. Informal feedback and our research indicates that specially designed support resources would be helpful including videos, simulations (that are appropriate to the educational context) and tools that support accessibility checking in various environments. Such resources are now under development as part of the research emanating from this project (Papadopoulos & Pearson, 2006).

Although activities have been evaluated through various methods (an online discussion forum and questionnaire, email questionnaire, and workshop feedback forms), and feedback has been good, there is little evidence to confirm that teaching staff have actually taken the issues on board in long term practice. More research is required to identify the extent to which embedding has taken place and the further support that is required to enable staff to be continuously and consistently inclusive in their e-learning practices.

The key to persuading staff to develop inclusive e-learning practices is by taking a pragmatic and incremental approach. Staff development activities should be designed to motivate academics by convincing them that inclusive practice means improving the learning experience for all students. Training needs to give academics the skills to make immediate changes and there should be a coherent institutional strategy for specialist support for e-learning accessibility.

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Going with the grain: Mobile devices in practice

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Fifty-seven alumni of a global Masters programme participated in research into their use of mobile devices. Drawing on questionnaire and interview data, the paper examines how far the devices were embedded in the personal and professional lives of these alumni, most of whom were aged 35–54. All had experience of online and distance education, and most worked in education or training. The study revealed some innovative uses of mobile devices, a selection of which is reported in this paper. The paper links the findings to wider debates about the changing relationship between learners and educational institutions, and the role of mobile devices in enabling individuals to engage in learning conversations. Data are provided on which devices were used by the alumni and for what purposes, and the paper explores the implications of these findings for educators.

Keywords: mobile devices, context, informal learning, moblogs, social networking websites

Introduction: The importance of context

Mobile devices have engaged the imagination of a number of educators, not least because such devices are a significant part of the grain of daily life. Armatas, Holt and Rice (2005), for example, argue that the near-ubiquity of the mobile phone gives it powerful potential for supporting online learning at Deakin University. They suggest a number of uses – such as providing off-campus students with 'audio-augmented feedback on assignments' (p.31), or pushing a welcome-message to new students' mobile phones.

In a different continent and context, Tamminen, Oulasvirta, Toiskallio and Kankainen (2004) envisage the potential of context-aware computing for helping Finnish city-dwellers to manage their everyday travel. They outline ideas such as a device that vibrates as the bus approaches, or that suggests a quicker route to enable a passenger to recoup time spent on an unscheduled chat with a friend. They argue that, through its focus on 'mundane doings in particular mobile circumstances' (p.136) – in this case, the journeys of twenty-five inhabitants in Helsinki – their study can give insights into powerful uses for mobile devices in a particular context.

The two settings and activities – learning at Deakin University, and navigating in Helsinki – have obvious differences. But in both papers there is an emphasis on threading innovative uses of technology into the existing fabric of behaviour. In Armatas et al. (2005) this approach is more implicit and pragmatic: since mobile phones are widely used, it seems logical to attempt to harness them for teaching and learning. And since students often request downloadable lectures to play on a mobile device, it makes sense for the university to provide them. In Tamminen et al. (2004) the approach is elaborated and explicitly ethnomethodological, focusing tightly on patterns of apparently mundane travel-related actions in a 'geo-culturally bound' context (p.142).

Yet in both papers there is a broadly user-centred approach. This is captured where Armatas et al. argue that, in influencing the university to provide downloadable lectures, students are 'shaping and driving the technology agenda' (2005, p.28). Mobile devices, contrasted with the centralized university-wide infrastructure for online learning, come to symbolize a greater focus on students and users, on the 'small, mobile and local' (ibid.).

These themes – uncovering patterns of use, and trying to work with them – provide part of the framework for the study reported in the current paper. Drawing on responses from 57 distance-education alumni, many of them older than the iPod generation, the authors explore and analyse how the respondents exploit mobile devices – mobile phones, smartphones, PDAs and MP3-players – for learning, teaching, work, social interaction and entertainment.

Many of the contexts reported here are informal and personal, while some derive from work and formal teaching. Some responses are tightly related to a particular setting, while others appear to be widely transferable. Many relate to teaching and learning – the teaching of music or languages, working with adults with learning difficulties, or the pursuit of an interest in photography that ends up celebrating, in the words of one respondent, ‘the joy of social interaction’. The study goes some way to uncovering the grain of participants’ use of mobile devices. More specifically, it throws light on some of the detailed choices that individuals make, why they adopt some patterns of use and not others, and how this illustrates ‘the importance and complexity of context’ to which Sharples, Corlett and Westmancott refer (2002, p.233).

The study also illustrates and analyses novel applications in the territory between formal and informal learning, and pushes further into the question of whether mobile devices – through their association with recreation, communication and fun – have a particular motivational power that can be harnessed for learning. This relates to work by Schwabe and Göth (2005), for example, in their study of a mobile orientation-game for new students at Koblenz University. Most students reported high levels of enjoyment, and findings such as this encourage Schwabe and Göth to aspire to tap the attraction of gaming so that ‘the classical dichotomy between fun and learning may be closed’ (p.215).

Tapping into deeply felt motivations, and the elision of dichotomies, also informs the other major theme explored in this paper – the use of mobile devices for both creating and ‘consuming’ online content. Several of the respondents in the current study indicated that, using mobile devices, they are creators and/or consumers. The findings give a perspective on some of the claims about trends in education and media that are set out in the next section of the paper.

Who’s powerful now?

Under a title that was deliberately and ambiguously apostrophe-free – ‘The students own education’ – Downes (2006) argued that we are moving to a situation where students ‘produce their own content’. He cited the high-volume website MySpace, where vast numbers of users – often in their teens – blog, publish personal profiles and upload photographs. This impulse to create and publish content – in MySpace and many other social networking websites – has profound implications, Downes argues. Insofar as some of the content on the web is ‘educational’, and insofar as users access it, the trend underpins the move towards personal learning environments where students can ‘access learning from a variety of sources’. If this happens, institutions lose much of their control over content and over the learning environment, while learners – as agile consumers and creators – take greater ownership.

This question of ownership elaborates one of the themes of the ascilite conference – not only ‘Who’s learning?’ but ‘Whose learning?’ To explore those questions, higher education may benefit from considering the media industry, where business models appear to be undergoing profound change – with, again, a shift towards the user. The questions could be rephrased as ‘Who’s writing? Who’s paying?’ The UK newspaper website Guardian Unlimited, for example, publishes talkboards of readers’ comments alongside content that its staff create especially for the web, plus stories that have been published in that morning’s newspaper.

This is less radical than Downes’ vision: rather than having innumerable webpages created by countless users, Guardian Unlimited provides defined and branded spaces – such as the one titled ‘comment is free’ – where readers post responses. And rather than the users creating all the content, Guardian Unlimited demonstrates that there is still a place for sharp, professionally written stories. What is more radical is that the website demonstrates not only that comment is free, but that much content is too. While the ink-on-paper version has a cover-price, much of the website can be accessed without payment. Yet, because of advertising revenue, it is reported to be commercially successful (Day, 2006).

There are implications here for higher education. If personal learning environments transform education in the way that Downes suggests, learners will access each other’s content and break free of a ‘centralized, institution-based system depending on a top-down structure and rigid standards’ (Downes, 2005). In that case, what role – if any – remains for institutions and their systems? Will academics, perhaps roughly equivalent to the Guardian’s journalists, continue to be paid to produce *some* learning content? And will universities, if at least some of their teaching becomes open content as at The Open

University (UK) and elsewhere, be able to recoup their costs – perhaps not with advertising revenue but with some other model of charging?

Finding a new model may be essential for educational institutions' survival, a point made by Heppell (2006). He sees power as having moved towards the learner so that the relationship with universities is now symmetrical. The point from Armatas et al. (2005) quoted earlier, that mobile phones are to some extent a counter to the centralized system, is consistent with this. In the context of this symmetry, Heppell asks (2006) how universities can 'move from being a big thing that did things for people, to being part of that agile, viral, peer-to-peer conduit of help and self-help and esteem and exchange'.

One way forward, he suggests, is to foster online communities of learners. Such an approach will be very familiar to university teachers, whether on campus, online or using a blend. Even the delights of Web 2.0 may not be as new as is sometimes thought. Lilley (2006), for example, has argued that '[i]f the blog has a common ancestor with the diary, MySpace shares at least some of its DNA with the scrapbook'. Nevertheless there is an obvious change of scale from diary and scrapbook to blog and MySpace, and individual users and learners now have vastly greater power to publish and access content.

The shift of power away from large institutions is hardly a new issue. Discussions of education in a post-Fordist future have envisaged that students would 'browse the global market' in their search for education (Pettit, 1998, p.250). But in the 1990s the question was usually whether the mega-universities, said to be locked into Fordist rigidities, would be agile enough to compete with smaller conventional universities and with the 'new all-electronic institutions' (Bates, 1997, p.102). That question – regardless of how it was going to be answered – still assumed that institutions of some kind would provide the education and content. Downes, in contrast, is suggesting something more radical, which appears to have long roots back to the free universities of the 1960s. This is a very different world in which mobile devices need to find their place.

The mobile promise

Within this context, mobile devices appear to offer a further strand of liberation and flexible learning. Cochrane, for example, has written of the potential for an m-learning 'revolution' (2005, p.156). Mobile devices are highly personalized, yet enable us to share ideas and information with others, and they promise access at any time from any place. They allow us to feed off the wifi environment for survival-information such as travel updating, and to enrich the experience of visiting a museum (Mulholland, Collins & Zdrahal, 2005). Moreover companies spend a great deal of money on making them attractive.

There are several advantages implied: that individuals will engage in learning at times when formerly they would have been doing something else; that they will be motivated to learn partly because the devices are attractive; that the devices enable communication from places where formerly it wasn't possible; that formal learning can mesh with existing patterns of self-publishing and online participation; and that mobile devices are particularly suited to multitasking, said to be one of the strengths of the 'millennial generation' (McMahon and Pospisil, 2005).

Of course, work remains to be done as teachers set out to integrate mobile devices into specific contexts of education. Corlett, Sharples, Bull and Chan (2005), for example, evaluated MSc students' use of a mobile learning-organizer that had been installed on a wireless-enabled device. Small screen-size, short battery life and limited memory were reported as significant problems. Thornton and Houser (2005) reported a study of 44 Japanese students who received small chunks of English vocabulary teaching-material on their mobile phones. Different chunks were sent out three times a day in the hope that students would study each chunk as it arrived. The authors report considerable success but note that over half the students did not engage in this 'carefully timed interval study': they saved the chunks for one time of day when they could concentrate on them in a batch (p.222). Clearly the mantra of 'any time, any place', even when technically feasible, does not always mesh with the way people integrate mobile devices into their lives. The next section sets out how, in the current study, the authors explored the issue of integration, looking at which devices the participants used, and in what ways.

Methodology

Participants

The participants were registered alumni of The Open University's Masters in Online and Distance Education, a global-intake programme developed by the Institute of Educational Technology (where the research was carried out, and where the authors of this paper are based). The alumni had completed at least one-third of the programme, and in some cases all of it. Although innovatory practice in e-learning is an important feature of the programme, it was not assumed that the alumni would necessarily include those for whom '[v]enturesomeness is almost an obsession' (Rogers, 2003, p.282). It seemed likely, though, that they would include those with valuable and interesting experience of using mobile devices – whether for formal or informal teaching and learning, work, social interaction or entertainment.

Of the 150 alumni who were invited, 57 (38 per cent) completed the online questionnaire – the first stage of the research. The questionnaire was administered anonymously, but respondents were invited to identify themselves if they were willing to take part in a follow-up interview. Thirty-one did so, and nine were interviewed.

Method: Online questionnaire

The purpose at this stage of the research was to gather both numerical and qualitative data on the breadth of participants' use of mobile devices: which did they use, for what activities, and how? Participants were asked whether they had used a mobile phone, smartphone, PDA (personal digital assistant) and MP3-player (for example, an iPod). For each device, they were asked whether they had used it for teaching, work, learning, social interaction, and entertainment (including quizzes and games). And for each activity they selected, they were asked to give an example.

This pattern of questions was designed to prompt participants about devices/usage. While this may have reminded them of usages they would otherwise have forgotten, it imposed a set of categories on their responses. To mitigate this, participants were invited to include informal uses (with friends, family or interest groups) when responding about their 'teaching' and 'learning'. There was also a catch-all question about any other uses, and in addition participants were asked how often they carried out specified activities with a mobile device, such as reading an e-book, browsing a website, or making a video clip.

Method: Interviews

The nine interviewees were chosen principally because their questionnaire responses suggested they were engaging in interesting/novel applications, but also to include some participants from outside the UK. The approach was not intended to uncover uses that were representative of the cohort, and indeed it probably skewed the data towards those with most experience of, and interest in, mobile devices. Nevertheless, interviews gave the opportunity to capture details of individual accounts and contexts, to move outside the categories of the questionnaire, and perhaps to capture innovative practice.

Although this broadly phenomenological approach might deliver detailed stories, it was not assumed that an interview could deliver an 'objective' account or even, at the other end of the scale, an 'authentic' one. Both interviewers and interviewees draw on their conceptions of what an interview ought to be. Holstein and Gubrium, for example, argue that interviews are 'collaborative accomplishments' between interviewer and respondent (2004, p.141). And in the stages of making a narrative of the interviewee's experience, gaps open up – what Miller and Glassner call 'fissures from the ideal text' (2004, p.127). The transcription of a recorded interview is one such fissure: in the current study, seven of the interviews were carried out by phone, recorded and transcribed, and two interviews were carried out by email.

If any interviewees had still been studying the Masters programme, their scripts might have come to examination boards chaired by the authors of the current paper. It was necessary to preserve anonymity, therefore, and all interviews were carried out by an experienced researcher and transcribed by an administrative assistant. The authors were not informed even of the gender of the interviewees – hence the use of 'A', 'B' etc, rather than pseudonyms, in the reporting and discussion below.

Questionnaire results

The respondents

About three-quarters of the respondents were aged 35–54 and a little over half (55%) were female. Over half lived principally in the UK, with most of the remainder living in continental Western Europe, and 5 living in Hong Kong, Japan, Peru and the USA. Nearly all described their profession as associated in some way with education or training.

Table 1 indicates that, although almost all respondents reported that they had used a mobile phone, only about half stated they had used a PDA or MP3-player. The picture in this area is continuously changing, and the data in the table (these were obtained in 2005) are inevitably a snapshot. Note that the figure of 18% for those who had used a smartphone may include respondents who had also used a mobile phone.

Table 1: Respondents' usage of mobile phone, smartphone*, PDA and MP3-player

'Have you used a…	no response (%)	Yes (%)	No (%)
…mobile/cell phone?'	2	95	4
…smartphone?'	2	18	81
…PDA?'	2	46	54
…MP3-player?'	2	52	48

Note. *n* = 57. Because of rounding up, totals exceed 100%; *defined in the questionnaire as 'mobile phone/PDA in one device'

Of those who had used a mobile phone, 96% reported using it for social interaction, and 78% for work. Outside these uses, the figures were much lower: 30% for teaching; 19% for entertainment, quizzes and games; and 17% for their own learning. Although the respondents may not have found the categories clear-cut, the reported differences in use are interesting and are discussed below. The questionnaire data are also reported and discussed more fully in Kukulska-Hulme and Pettit (2006).

Table 2 gives the relative frequency of various activities involving mobile devices. The prevalence of text-messaging is not surprising; but it is worth noting – and will be picked up in the discussion below on use of content – that about one-quarter of respondents reported that they accessed websites at least once per week. This frequency (though not necessarily the amount of time spent) is nearly as high as for listening to an audio file.

Table 2: Respondents' frequency of participation in various activities with mobile devices

	no response (%)	Never (%)	<1 per month (%)	1 per month (%)	1 per week (%)	A few days per week (%)	At least once per day (%)
Browsing mobile (WAP) websites	–	56	18	2	11	11	4
Browsing 'ordinary' websites	2	56	14	5	2	5	16
Reading e-news	–	51	14	7	5	14	9
Using a location-based service*	2	67	9	11	9	4	–
Sending text messages (excluding Bluetooth use)	2	16	5	5	16	19	37
Reading an e-book	2	65	16	5	7	2	4
Listening to an audio file	2	44	18	11	4	11	12
Recording own voice	4	58	23	9	5	2	–
Making a video clip	4	60	26	5	–	5	–
Sending a video clip from a mobile device	–	86	11	4	–	–	–

Note. *n* = 57. Because of rounding up, some totals exceed 100%; *defined in the questionnaire as 'e.g. to find nearby taxis, bank, restaurant etc'

Disadvantages for own learning

When asked to state one or more disadvantages of mobile devices in relation to their learning, 15 respondents cited usability problems (with small screen-size the most prevalent). Technical difficulties (for example, short battery life) were cited 11 times, accounting for most of the remaining responses. Similar usability and technical difficulties have been reported in Kukulska-Hulme (2002) and Waycott and Kukulska-Hulme (2003).

Interview data

The nine accounts were analysed in relation to a number of issues raised in the introduction:

Context (travel)

Interviewees ‘A’ and ‘B’ reported that changes in the travel environment had had an impact on their choice of device. One spoke of the benefits of an MP3-player over a book, ‘especially as [bus companies] are converting to standing-up buses’. For the other, a new style of seating on trains meant it was difficult to accommodate a laptop, whereas a PDA was ‘fantastic in those circumstances’.

Device choice

Interviewee ‘C’, living in a city where free wireless access is widely available, reported ‘huge dependency’ on a laptop; the mobile phone had been relegated ‘just to taking phone calls’. Once interviewee ‘D’ learned to type well, the laptop’s keyboard became particularly beneficial, whereas for ‘B’ the PDA was ‘something I am never without’, even on holiday.

Size matters, not surprisingly, in the choice of device: for interviewee ‘E’, PDAs were rejected in favour of a laptop (bigger keyboard) and a mobile phone (smaller device). The two selected devices supported each other: when ‘E’ was travelling, s/he set the mobile phone to bleep when an email arrived and, though ‘E’ might read an email on the phone, s/he usually typed a reply, at a later point, on the laptop.

Speed can also matter: for language-learning, ‘B’ preferred a PDA over handwriting because it was *slower*: s/he argued that this led to more careful thinking before writing, a ‘distillation process’ (in addition to avoiding the need for transcription later).

The attraction of the mobile phone

Interviewee ‘I’, a teacher of Spanish, had asked pupils to send text-messages in Spanish to the teacher, who was on a visit to Spain. S/he reported that pupils added personal messages asking about the weather and food, and s/he concluded that some ‘believed it was a personal thing, not homework – somehow they do not link the idea of mobiles with classwork’.

Formal settings

At times, devices were combined in ingenious ways to support formal learning. Interviewee ‘B’ selected a brand of PDA with a high-quality built-in microphone, for a scheme where s/he was working with music teachers. The device was good for recording pupils’ musical performances and progress, and was less frightening than a free-standing microphone. At the same time, the built-in speakers were not good enough for playback, so battery-powered portable speakers were attached. Interviewee ‘B’ also spoke of a colleague who had used an MP3-player at the end of each lesson to record adults with learning difficulties speaking of what they had just done. They could go back at any time and listen to the recordings from previous lessons: ‘a fantastic way of getting adults with learning difficulties to sort of reflect on their own learning, and also of course provide evidence for anybody else’.

Content

Where interviewees reported creating content, it was often for their work or individual study (though most frequently it was text messages). In terms of consuming content, interviewee ‘G’ spoke of downloading articles, newspapers and novels to a PDA – to avoid having 'dead time': for this interviewee, it was essential to have material on mobile devices to read while travelling. 'G' also reported that the PDA had led her/him to keep a diary: 'I don't think I would keep diaries if I didn't have a PDA'. 'E' reported at times using the mobile phone, while travelling, to access news websites designed for mobile devices: 'they have structured their articles for very short paragraphs'. 'H' also reported accessing the internet with a mobile phone, and using an MP3-player during frequent travel to listen to audiobooks, podcasts, lectures. The device enabled other activities: 'I take notes, follow up on books, articles and websites mentioned. Sometimes I discuss what I have heard with my co-workers.'

Social networking websites, informal learning

Interviewee 'G' reported using a mobile phone to take photographs and post them to a blog. The initial motivation was to keep family and friends up to date when the interviewee was travelling. But this usage evolved: the moblog enabled users to comment on the photographs, and these comments came to represent

> status or kudos from the community…I've started to get a sense of what gets comments on the site, and there's a kind of genre of photos that they like, and you start to play that game…you figure out what pushes people's buttons.

'G' also had two examples of learning conversations that grew out of the posting of images. In the first example, a female user had noted a poster for a design competition and commented that all the judges were male; this led to a discussion on sexism and design. 'G's second example relates to the London bombings of 7 July 2005:

> [on the moblog] there were photos of people who were actually there, not some journalist hovering around the perimeter of ambulances. It was there that we first saw that photo of that guy with the cloth over his face at the tube station, and this appeared very, very quickly.

The bombings led to a heated political discussion that, reported 'G', became so engaged that 'the server overloaded and went down that evening, and I actually learnt quite a bit…'

Discussion

The study was intended to establish which mobile devices were used by alumni of a Masters programme, and for what purposes. The intention was to see how far the devices were embedded in the personal and professional lives of people who had a particular interest in online and distance education (the subject-area of this global Masters). Of all the mobile-enabled activities that were technically feasible, which did these alumni – mainly in the 35–54 age-range – actually decide to engage in? The answers would have implications for educators interested in the use-patterns of similar learners, and might also reveal whether the alumni were undertaking new forms of 'learning', however personally and informally that is interpreted. In addition, since many of the alumni were themselves professionally involved in education or training, the study might uncover innovative mobile-related practices.

The data indicate that, while nearly all participants had used a mobile phone, only about half had used a PDA or MP3-player. Usage is changing, and data of this kind can only be a snapshot. Nevertheless they suggest that educators need to be wary, when designing educational activity for learners like these alumni, of counting on incorporating access to PDAs or MP3-players.

Of course, with careful design and support, innovative use can be achieved: educators don't have to confine their ambition to what's familiar to learners, and there are reports of success in introducing students to new devices/uses. There are also reports of relative failure, and the current study suggests some of the reasons. One of the distinctive contributions of the interviews was to illustrate how the participants wove particular devices and practices into their daily lives, especially when travelling. The fit appeared to be intense but provisional, and dependent on factors often outside the control of the individual, and certainly of any educator wishing to design learning around smartphones, PDAs or MP3-players. When participants chose or rejected a particular device, they cited a number of unpredictable factors – changes to the design of buses or train seats, for example, improvements in typing skills, whether a device 'looks stupid', or individual trade-offs about the value of carrying a larger device in order to gain a keyboard. These findings draw on only a few of the interviews, but are consistent with a number of other reports on the integration of mobile devices into the fabric of daily life.

Some of the interviews indicate the particular importance of travel periods for study, for informal learning or just for engagement with news and other material. This is consistent with Thornton and Houser (2005): a significant number of the participants in their report used the travel period to access the chunks of language material that had been sent to them at intervals during the day on their mobile phones. For these participants, travelling home was the time when they felt able to study, overriding the carefully paced delivery through the day that the educators had designed. Wray (2006) also emphasizes the importance of travel periods for engagement with material on mobile devices. He cites a UK trial, by a phone operator and broadcaster, of mobile television: 'Some users said they had changed their commuting habits so as to catch their favourite shows while on the bus'.

If educators have ambitions to use mobile devices to exploit their learners' commuting time, they will need to examine its patterns carefully. Writing of context-aware technologies, Tamminen et al. argue that acceptability 'is dependent on how well they fit into the routinely carried out mundane processes of everyday life' (2004, p.142). Educators may not necessarily need to stay within existing patterns of everyday life, but it seems sensible to find out first what those are.

The current study indicates, not surprisingly, that nearly all participants had used a mobile phone. This is a first step towards the position of Prensky (2005) and others who advocate their use in teaching and learning. However, only about one participant in six reported using a mobile phone for their own learning, a lower usage than for teaching, and far lower than for work and social interaction. Designers of learning activities on mobile phones may therefore need to provide initial support to such learners, but intuitively this looks far easier than persuading learners to adopt a new device. And device-convergence, if it happens, may mean that new functions – and new educational potential – can be smuggled in under cover of the coolness or convenience of the 'mobile phone'.

The findings on mobile-related activities (Table 2) indicate that about one in four respondents used a mobile device to access wap-enabled and other websites at least once a week. This figure is lower than for text-messaging, but not much lower than for listening to an audio file. Further research is needed into which sites are accessed, for how long and for which activities. Nevertheless the current study suggests that, for learners like these alumni, accessing websites could become an important use for mobiles.

The data on accessing e-news indicate that, in at least some cases, respondents were accessing sites that provided content. In the activities shown in the table, creating content – for example, recording one's own voice – is markedly less popular than listening to a recorded audio file. This may not be surprising, but it is useful in the context of the debate about content-creation and content-consumption. The data in the table also indicate that one in ten respondents reported using a mobile device to read an e-book at least once a week – again, consuming (usually professionally prepared) content.

In addition to giving insights into device-choice, the interviews provided a vivid account of the use of a moblog – where photographs were uploaded, news captured and discussions initiated. Interviewee 'G' spoke of the satisfaction of receiving positive feedback on photographs, and this matches the point that Lilley made about his own experience of such a site: '…when someone commented favourably on one of my own [photographs], it was a unique moment' (2006, p.8). In the current study, 'G' highlighted the role of individuals in capturing powerful and almost immediate images of the aftermath of the London bombings in July 2005. This accords with Owen's argument (2005) that 'the images that defined the media coverage of the July 7 London terrorist bombings […] came not from professional news crews but from everyday people'.

These points lead back to the discussion earlier, on whether there is now greater symmetry between individuals and news organizations, and between learners and institutions, and whether mobile devices have a role to play in this. On the one hand, the power of anyone with a suitable mobile to create content – as exemplified in the current study by interviewee 'G' using a moblog – seems close to Downes' ideal of users starting to create a personal learning environment. 'G' created content in the light of feedback, and engaged in conversations that elided the boundary between personal interest and learning.

On the other hand, although Owen may be correct about the role of 'everyday people' in this instance, it is also true that content published by individuals on the web is often inflected with issues of status, sometimes relating to the content, sometimes to the individual. Interviewee 'G' indicated that some images received 'status and kudos' while others elicited no reaction. Mitchell (2006), writing about the creation of academic blogs, refers to claims that certain blogs are likely to attract far more readers than a paper in a scholarly journal, and are becoming crucial in some fields for academic reputation and status.

Conclusion

The study was motivated partly by a wish to uncover the ways in which mobile devices were used by alumni of the Masters programme. This approach, of looking at the grain of current use, is consistent with that of a number of researchers, including those whose primary interest is context-aware computing and who have put a very useful emphasis on the detailed texture of lives in specific contexts. The interviews in the current study, though not ethnomethodological, attempted to engage with some of that detail, and suggest that interviews can be an important source of data to combine with numerical data in this area.

Taking the mobile phone as the most widespread device at present, it is important to study the detail of how it is used, accepting that one group of users may exhibit very different patterns from another. The differing choices of groups, and of individuals within a group, will be affected by a bewildering array of factors, and to some extent these will continue to cut across educators' attempts to harness the near-ubiquity, in many parts of the developed world, of this device.

Given this emphasis on actual use-patterns, educators may at times wonder whether they should stay within those patterns, or whether they can reasonably ask learners to adopt a new device, or at least a new usage of a familiar device. Working with the grain may look desirable but can be restrictive. The most effective approaches are likely to be open to both perspectives – uncovering existing patterns and at times working within them, but at other times seeking to enlarge their scope to enable more ambitious learning.

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Implementing new technologies across the organisation: The LAMS@Macquarie project

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The LAMS @ Macquarie University Implementation Project is an enterprise-wide project which aims to develop and promote the use of LAMS (the Learning Activity Management System) across the University. This paper is a brief exploration of some of the early indications from the research conducted during Stage 1. We consider some of the challenges of adopting the next generation of e-learning tools, in particular the issues surrounding adoption and dissemination, establishment of a community of practice, and creation and sharing of reusable learning designs.

Keywords: implementation, LAMS, Learning Activity Management System, reusable learning designs, community of practice

Introduction

The LAMS@Macquarie University Implementation Project (LAMS@MQ project) was conceived as a two year project to encourage the wider adoption of LAMS, the Learning Activity Management System, at the institution where the software is being developed. At the time of writing, the project had been in operation for 12 months (July 2005–June 2006) and was preparing for a second year of funding. Stage 2 was expected to allow for embedding of the processes in university systems and the wider dissemination of innovation, potentially leading to identifiable quality improvement in teaching and learning. This brief paper is not the full evaluation report, but gives indications of the challenges faced. A more comprehensive data analysis will be reported in a future paper.

The aim of the project was specifically to integrate, develop and promote the use of LAMS across the University. This was achieved through an education and staff support program, and a technical integration of LAMS into WebCT (the current Learning Management System, LMS), resulting in single sign-on access to both systems. Effective communication was a central concern of educational development, training and dissemination strategies during the implementation, a concern shared and noted by the University of Queensland in their LMS implementation (Steel, 2005). The choice of language adopted when working with staff was paramount to ensure ownership of change. Project, communication and evaluation plans, and reference to a steering committee were key project management elements.

Methodology

We took an action research approach to capture the complexity of the relationship between institutional change and individual and staff practices. The full evaluation plan is available at the project website, http://www.melcoe.mq.edu.au/projects/LAMS@MQ/evaluation.htm, and includes details of expected outcomes, indicators etc. Space prevents us from including this in this paper. Our general research questions were: 1) How does LAMS impact on staff and students? 2) What is the efficacy of LAMS for the Macquarie context? 3) What are the implications for future use? Formative and summative data was gathered from a range of sources and stakeholders: informal discussions and interviews with staff; observations of LAMS classes – virtual and actual; training and support sessions; student online forums; the LAMS Community forums and sequence repository; reflective journals; project documentation and communications; server logs; a student and a staff online questionnaire; and seven focus groups – one with staff and six with students.

Implementation

The results of previous trials of LAMS in Australia and the UK (Russell, Varga-Atkins, & Roberts, 2005; Gibbs & Philip, 2005; JISC 2005) had shown that, while individuals might be encouraged to use LAMS, broader adoption was unlikely unless enterprise-wide systemic support was provided, both technical and educational. The project was funded through an internal grant and strategically integrated with the teaching development grants scheme. The importance of commitment from the organisation to the success of educational change is well known (e.g. Ely, 1999; Kenny, 2002, in Kenny 2003; Mckenzie, Alexander, Harper, & Anderson, 2005); and Weedon, Bricheno and Chidwick, (2004) in the Joint Information Systems Committee (JISC) report from the UK on the impact and introduction of large-scaled networked learning concluded that: 'Large-scale networked learning appears to have the greatest impact in institutions that implement it through complementary top-down (managerialist) and bottom-up (develop core competencies) trajectories (Nicol et al., 2004 in Weedon, Bricheno & Chidwick, 2004)'. However, they noted important exceptions where there was staff support for materials development, resulting in high levels of engagement with networked learning. The project adopted all three strategies identified by the JISC: top-down institutional commitment (funding and political support); bottom up support (training and educational development); and staff support of 'materials' development through educational development support. Further, if we were to measure Stage 1 of the project against Ely's (1999) seven 'conditions' of successful implementation, it would rate reasonably well (see Table 1).

Table 1: Rating of the project against Ely's conditions for successful implementation

Condition	**Rating**		
	High	**Medium**	**Low**
1 Commitment from the organisation	X		
2 Participation of key stakeholders in planning and design decisions		X	
3 Leadership and role modelling by immediate supervisors			X
4 Provision of adequate resources	X		
5 Provision of adequate time for innovators to learn new skills and realise the implementation		X	
6 Assessment of the level of knowledge and skills of the likely users	X		
7 Rewards and incentives to motivate users		X	

Ely does not include context in his seven conditions, but inevitably politics, economics and culture are important factors that impinge on success. A number of these factors will become problematic in Stage 2 because of changes in the executive of the organisation. This may affect (1), (4) and (7), i.e. commitment from the organisation, resource provision, and rewards and incentives, and the context of implementation, as there is now a much greater emphasis on research within the University.

Adoption and impact across the organisation

While LAMS is a relatively easy technology to use, with low technical requirements, evidence from Stage 1 indicates that there are still barriers, actual and perceived, technical and educational, which impede more rapid uptake of the technology, and therefore positive impact on teaching and learning. LAMS finds a place within current learning and teaching environments as a tool for better facilitating activities in an online or blended learning environment, and moving groups of students through collaborative activities. Evidence from the project indicates that in the university context LAMS is most likely to be used as an adjunct to a Learning Management System. Its visual representation of educational design as a flow of tasks helps make the pedagogy for any activity more explicit to the designer: our data indicates this has promoted reflection on activity design by some users authoring in LAMS, both students and teachers. LAMS also enables the capture, sharing and modification of reusable learning designs.

LAMS has been trialled in the project in 30 discrete units over the twelve months with 13 repeated units (total of 43 units). It is expected those numbers will at least double in Stage 2. In addition to staff authoring of sequenced activities, students in the School of Education have also authored their own sequences as part of assessment activities. Table 2 provides some of the usage statistics. There has been a steady growth in usage over the twelve month period, but as Marshall (2004) and Steel (2005) confirm, effectively embedding ICTs in a sustainable way into teaching and learning programs is a long term process, which involves cultural, structural, strategic and political change. Any of these factors can act as barriers to adoption of innovation.

Table 2: Usage of LAMS over first 12 months of project

Item	Number
Units where LAMS implemented, i.e. 'live' (includes repeated units)	43
Repeated units	13
Total staff and students accounts created on main project server	1131
Staff/lecturer accounts created	101
Student accounts created (excludes deleted accounts)	833
Departments or Centres with accounts	31
Organisations created on LAMS@MQ server	34
Staff using LAMS in more than one unit.	8
Program wide usage (commitment to substantial no. of units)	3
WebCT/LAMS integration accounts (over 6mths)	104
Staff accessing LAMS through the integration	18
Departments where students authoring sequences	3
Sequences created by students for assessments	235
Attendees at formal training/demos/seminars	374

Barriers and challenges

Overall, some of the barriers to implementation revealed through the data in Stage 1 are as follows:

Educational and professional development barriers

Previous conceptual models of e-learning and e-learning tools held by teaching and support staff
Comparison of LAMS with previous e-learning systems may inhibit understanding of the efficacy of the innovation, e.g. the value of LAMS to support collaborative activities and systematically facilitate activity flow, modelling tutorial patterns of engagement, rather than acting only as a tool for content delivery or communication. (This is a cultural change issue.)

Professional development and change management issues for academic and support staff
For example, using LAMS as a collaborative tool *within* tutorials and laboratory sessions requires new strategies, compared with using the software as a tool only for independent study by students outside face-to-face attendance times. Additionally, use of the LAMS repository of templates, i.e. re-use of learning designs is a relatively new approach. (Requires educational and cultural change.)

Poor resourcing of casual or junior staff to implement innovation
These staff are often the most enthusiastic, willing to take risks and be innovative, but are seldom paid to attend training or spend time on development. Further, they have limited time to contribute to a community of practice or mentor other staff, activities which help sustain innovation on a wider scale. (Structural issue.)

Lack of just-in-time pedagogical support
A time and resource issue. There is a need for mentoring by colleagues and/or educational support personnel to, e.g., provide feedback on the efficacy of the design model used in any LAMS sequence or series of activities, to assist with judging the probable time to be allocated for collaborative tasks (which is usually more than predicted), and to troubleshoot technical issues. (Requires structural change to ameliorate.)

Time lag between first trials of the LAMS software and actual implementation
This has been observed to be 12 months or more in some cases. (Political issue to communicate this to executive.)

Short courses which have only limited windows of opportunity for implementation of the technology
For example, where LAMS activities run in a 10 week course staffed predominantly by casual teachers, issues of staff readiness, training, support, and access emerge. If the implementation opportunity is missed, there is no time to try LAMS again with the same cohort of students, and staff. (Strategic issue.)

Courses with large classes, or where there is team teaching make change more difficult to implement
Coordinating a team of academics to undertake technical and pedagogical change is complex, and some staff perceive equity issues across the cohort if only a small group of students trial the technology, so will not implement LAMS until the whole cohort is able to do so. (Strategic issue.) Further, there is a monitoring issue when tutorial numbers are high: limitation of the LAMS monitoring interface (V1.0.2) to provide adequate labelling of multiple Noticeboards with student records – it is cumbersome and confusing. This should improve in LAMS V2, to be used in 2007.

Technical barriers (most of which are structural issues)

Local configuration issues
For example, there were problems accessing the LAMS server across the main campus from some lecture theatres due to varying local subnet mask configurations.

Access
Access to WebCT and LAMS was delayed in some courses where there was early enrolment or non-standard patterns of attendance. Sequences set early in the course could be jeopardised.

Scalability
The number of concurrent users accessing LAMS had to be controlled in Stage 1 – both a software and server issues. LAMS V2, , the upgrade for 2007, however, will be suitable for use at scale, installed on the central Online Teaching Facility, not the lower capacity Stage 1 server.

Reliability of IT infrastructure across the University
Organisational network system downtime was often interpreted by students and sometimes staff as a problem with LAMS, not as a network issue.

Tolerance of technical failure related to system or software failure
This varies enormously with individuals, but was most often related to Authoring in LAMS, rather than use of the software as a Learner, e.g. LAMS V1.0.2 has no auto-save, and loss of work whilst authoring through the browser interface (which can time out) was a common problem for some novice users.

Dissemination through a community of practice

Effective dissemination is one of the greatest challenges of a project which encourages new ways of engaging, relating and communicating in learning and teaching. It is easy to use new tools in traditional ways and, unfortunately possibly ineffective ways (Oliver & Omari, 2001). So, to disseminate best practice there is a need to build a community of practice where understanding, knowledge and problems are shared, as researchers such as Wenger, McDermott and Snyder (2002), and Brown and Gray (2004) encourage. Informal networks across disciplines and the formal structures of the organisation are important for sharing ‘culture’, and sustaining innovators. As a focus for sharing and dissemination in this project, we encouraged the use of the LAMS Community website and learning design repository (http://lamscommunity.org). Usage of the special private forum for Macquarie personnel has been slow to date, and anecdotal evidence suggests that staff may read forum discussions, but not actively contribute. A research writing group around LAMS is to be implemented, and the LAMS Community is expected to act as a focal point for the group, supplementing face-to-face meetings. The LAMS Community repository contains reusable learning designs stored as .las files that can be freely downloaded and shared, providing a significant editable resource for teachers and students. Ten of the designs in the K-12 section are exemplar student contributions created for assessment by Macquarie students. Of the 1313 users in this international community, 80 are from Macquarie. The repository holds about 97 sequences or templates, with varying degrees of additional implementation information attached in the form of text files and metadata. Licensing is governed by the Creative Commons approach, i.e. designs are free to share, but acknowledgement of the author is a condition of use.

Issues which our research show may impact on usage of the repository, and therefore dissemination include the following:

- The peer review system is unregulated, and no criteria are set by which judgements can be measured.

- The review system is not sufficiently well used by members so, for those searching through the database for reusable designs, indicators of the quality of sequences are not necessarily apparent.
- Sequences cannot be previewed in the repository; a second stage in the process of re-use is required – the sequence must be downloaded from the repository and then uploaded into LAMS.
- Contribution of designs is a public act which exposes the author's teaching and learning approach.
- Copyright material in the sequence must be removed before metadata is added prior to publication.
- Despite best intentions, uploading a sequence is a task that assumes low priority – only four staff who have taught with LAMS at Macquarie have contributed sequences to the repository.
- There is no explicit reward for contributing to the repository – a political and educational issue.

Conclusion

Stage 1 of this project, when measured against the JISC and Ely criteria, is well founded for success. However, embedding LAMS as an effective technology to enrich teaching and learning across the organisation cannot be achieved in twelve months. Promotion of a community of practice, and availability of a reusable learning design repository provides support for sustainable practices and dissemination. Nonetheless, to improve usage of the repository, more attention to issues of cultural change, and reward systems (requiring strategic, political and structural change) need to be put in place to foster a broader culture of reuse and dissemination of best practice.

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Tools used in Learning Management Systems: Analysis of WebCT usage logs

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This paper investigates the use of tools within WebCT Campus Edition 4. Internal usage tracking data was analysed to determine the extent of use of WebCT tools within individual units of study at five universities, primarily Murdoch University. An innovative algorithm, using a geometric distribution, was used to categorise use of the tools. The research found that WebCT was heavily used in a teacher-centred mode, with the majority of use in provision of content to students, and in students reading messages from their lecturers. Tool use which emphasised student-centred learning was only apparent in a small number of cases. These results were relatively comparable with those from four other universities. The paper concludes with a discussion of the implications of the observed behaviour.

Keywords: WebCT, usage logs, Learning Management Systems

Introduction

Web-based Learning Management Systems (LMS) have been available for approximately ten years. These systems combine the ability to manage student access to content with management of results. They also provide numerous tools through which students can interact with online content, their lecturer and other students. WebCT and Blackboard have been the pre-eminent LMS suppliers, and they have recently merged, as part of a maturing of the online learning environment over the last decade.

While initial proponents envisaged a learning environment without face-to-face contact, the majority of university online learning use is as a supplement to traditional face-to-face teaching (Harris, Yanosky, & Zastrocky, 2003), in what is called variously mixed-mode, blended or flexible learning environments (Lefoe & Albury, 2004). A survey of online units of study offered at Australian universities in 2002 (Bell, Bush, Nicholson, O'Brien, & Tran, 2002) indicated that only 0.8% of 63,468 units of study[i] offered online had no face-to-face component.

While it is clear that Learning Management Systems are widely used around the world "Millions of users at more than 3,650 clients in over 60 countries worldwide" (Blackboard, 2005), little is known of the extent to which the set of LMS tools is used. This research seeks to investigate the extent of use of LMS tools at five universities which use WebCT Campus Edition 4. WebCT maintains internal usage logs which record the date and time a user accesses a tool or content page. The author had previously used these logs as one source of data in research about how students interacted with a web-enabled Biology unit (Phillips, Baudains, & van Keulen, 2002). An automated script was developed to easily access the comprehensive data available in the usage logs, and analyse the behaviour of individual students.

Other work looking at the analysis of automatically recorded system data is relatively rare. Lowe and Koppi (2005) used usage logs to identify WebCT courses which had high levels of student activity, and interviewed their designers in order to identify exemplary practice. This information was subsequently used for professional development. Other researchers (Judd & Kennedy, 2001; Kennedy & Judd, 2004) have explored the use of audit trails to analyse the use of multimedia medical courseware.

Learning Management Systems and pedagogy

At the time that Learning Management Systems were first developed, there was a significant, pre-existing body of literature, based on social constructivism, about appropriate ways to engage students in learning online. See, for example, Harasim, Hiltz, Teles, & Turoff (1995) and Collis (1996). Some systems, such as Virtual U, developed at Simon Fraser University, were designed around this approach.

On the other hand, many initial LMS developments were derived from a distance education model, a teacher-centred, transmissionist approach. The world-wide web was seen as an alternative and more flexible delivery method than paper and the postal system. WebCT was developed from this perspective by a computer scientist (Goldberg, 1997), with much of the early development done by students in projects. When the author initially investigated both Virtual U and WebCT in 1997, he was concerned about the pedagogical implications of the design of the system. Virtual U, while designed from a social constructivist perspective, was a relatively immature product at the time. However, WebCT, whose interface encouraged a focus on delivery of materials, had a rich toolset which permitted student-centred learning activities to be developed.

This rich toolset, and the responsiveness of the developers, led to explosive uptake of WebCT in the 1990s. However, while early marketing efforts focussed on the rich toolset, there was an underlying message that online education was all about delivering materials to students. A change in marketing focus has taken place in the last few years, with both WebCT and Blackboard claiming that they facilitate student-centred learning. For example, *"Using WebCT Campus Edition's rich feature set, instructors can facilitate group-centric learning, personalize content and activities for students, and positively impact learning outcomes."* (WebCT, 2006).

The impact of the architecture and interface of LMSs on pedagogy has been discussed, largely informally, at conferences and in online forums over many years. See, for example, a recent discussion on the ITForum list (http://www.listserv.uga.edu/cgi-bin/wa?A1=ind0607&L=itforum). It was the author's belief that online courses could be developed from a student-centred perspective because of the rich toolset available. However, others have argued that LMSs have forced them to 'dumb down' their teaching.

A centralised Flexible Learning Initiative (http://www.murdoch.edu.au/admin/cttees/flic/) at Murdoch University focussed on making existing print-based resources available online and had led to wide uptake of WebCT (Phillips, Cummings, Lowe, & Jonas-Dwyer, 2004). However, a suspicion arose that WebCT was being used mainly to deliver content to students, with little use of the interactive tools.

Method

The research question was "To what extent are the various WebCT tools and functions used in individual units of study at university? The outcomes of this research could also be used to explore whether the LMS influences pedagogy. It might also be used to confirm or dispel WebCT's claim that their product is student-centred. This research can be classified as Boyer's (1990) Scholarship of Integration**,** connecting knowledge and discovery into larger patterns and contexts.

It was clear that the WebCT usage logs could be used to answer these questions. However, the script referred to in the introduction analyses only a single course at an individual level. The Tool Use product developed by Peter Love (http://www.netkno.com/soft/toouse/) was considered, but it analyses global use of tools across an entire WebCT installation, and the research question sought to break this down by units of study.

The work described below was prototyped by running the existing, unit-based script across all active WebCT courses, and aggregating the total use of each tool for each course. Excel was used to join this data with enrolment data in each course to calculate an average use per course of each WebCT tool.

Algorithm

This section describes the development of the algorithm[ii] used to analyse the WebCT usage log data described in this paper. WebCT Campus Edition 4 (and earlier versions) records internal usage logs for each student in each course. A folder exists for each student in the course. A log file in each folder records the username, the location in WebCT, the type of tool used and the date and time. Each item is separated by a comma. The example below indicates that a student with user ID 19900912 (item 1) accesses a page of html content in a Content Module (item 2), which is generally classified as 'Notes'. This occurred on the third of March 2001 at 18:58.

```
19900912,mainlabs/cells/N265_cells_answers.html,Notes,03/03/01 18:58
```

WebCT records the use of many tools. The names and descriptions of each of the tools referred to in this paper are listed in Table 1.

Table 1: Names and descriptions of each of the tools referred to in this paper

Name	Description
Home Page	Navigating to the Home Page
Content Page	Navigating to a page of unit material in a Content Module
Articles Read	Opening a Discussion forum article
Original Posts	A message posted into a new discussion forum thread
Follow ups	A follow up message posted into a discussion forum thread
MyGrades	Use of the MyGrades tool to display student marks
Assignment	Use of the Assignment Dropbox tool for electronic submission of assignments
Quiz	Use of the Quiz tool
Calendar	Use of the Calendar tool
Mail	Use of the Mail tool

The analysis tool processes each course and counts the number of times each WebCT tool is present in the logs for all students in that course. This provides an aggregate usage of each tool in each course. The number of folders corresponds to the number of students, so it is easy to calculate an average use per student of each tool in each course.

An example of this data is presented in Table 2[iii], showing the average use of each tool by students in that course. For example, course AIS180s1 had 114 enrolled students, and these students accessed the WebCT Home Page 56.9 times on average.

Table 2: Example of averaged raw data extracted from the usage logs for each course

Course		AIS180s1	AIS181s2	AIS201s2	AIS205s2	AIS274s2	AST258s2	BIO103s1
Number of students		114	56	30	44	85	19	284
Average accesses per student	Home Page	56.9	152.0	69.0	29.0	38.7	80.5	134.5
	Content Pages	10.7	92.7	13.6	4.2	4.9	10.5	25.8
	Articles Read	0.1	125.0	0.1	0.1	1.7	3.5	17.6
	Original Posts	0.1	0.7	0.1	0.0	0.1	0.3	0.8

Because Murdoch has hundreds of courses, it is difficult to detect overall trends from this type of data. However, this level of aggregation can be useful for analysing and comparing the characteristics of individual courses.

A common procedure in statistics to detect overall trends is to group the data into categories of use, typically quartiles or deciles (four or ten categories). However, when an analysis by deciles was carried out, most of the usage clumped into the bottom 20%, with little representation in the other deciles. That is, the arithmetic progression used to generate the deciles resulted in too little discrimination between the categories. Therefore, a geometric progression based on powers of two was used as the method of categorising the data. Average use per student of a tool >0 and <=1 is put into category 1; average usage >1 and <=2 is put into category 2; category 3 is >2 and <=4, etc. A consequence of this choice is that the lower categories correspond to a relatively narrow range of average use, while the higher categories correspond to a much wider range of average use. Because tools in many courses have zero usage rates, a special category 0 was also created.

The data resulting from this categorisation is shown in Table 3. The Home Page row can be interpreted as: there was one instance where the average hit rate per student was less than or equal to 1, one instance between 1 and 2, and 21 instances where the average hit rate was between 4 and 8. In terms of the Content Pages row, there were five instances where Content Pages were not accessed at all. The geometric distribution provides a relatively even discrimination between categories: Home Page use is biased towards the higher categories, Content Page use is fairly evenly spread across categories and Articles Read cluster towards the lower categories.

Table 3: Categorisation of the raw data according to a geometric progression

Range	0	>0 <=1	>1 <=2	>2 <=4	>4 <=8	>8 <=16	>16 <=32	>32 <=64	>64 <=128	>128 <=256	>256
Home Page	0	1	1	1	21	25	72	103	80	29	6
Content Pages	5	18	26	38	64	79	44	44	18	3	0
Articles Read	8	144	15	28	32	27	27	26	18	12	2
Original Posts	8	306	10	10	0	0	1	2	0	0	2

A perl script was developed to automate this algorithm across any selected WebCT courses. It is freely available to the WebCT community under a Creative Commons licence[ii]. Input options to the script enable subsets of users and subsets of available courses to be selected.

There are several shortcomings in the data which is logged by WebCT:

- While student data is cleared every time a course is reset, WebCT Designer data is retained and accumulates over years.
- From some time in 2001, WebCT stopped recording designer use of any tools except Home Pages.

Therefore, the usage tracking data contains an over-representation of designer hits on home pages, and an under-representation of hits on other tools. These factors are unlikely to affect the outcomes of this work.

Results

Results are presented first for Murdoch University in 2006, then as a trend over three years and then as a comparison across the five universities in this study.

Murdoch University 2006

Data from semester 1, 2006 reveals that WebCT was accessed 7,630,530 times by 33,541 student seats (students in units). This corresponds to 11,652 individual students in 385 units of study. This is 94.6% of Murdoch's 13,308 coursework students. It is clear that WebCT is widely used at Murdoch and it impacts on the majority of students. However, which tools are most widely used? This data is shown in Table 4, which lists the total usage of the most commonly used tools, together with their average use per course. A number of other tools were recorded as being used, but their use was very low, and they have been excluded from this study.

Table 4: Descriptive statistics of the most widely-used WebCT tools in Semester 1, 2006 at Murdoch

	Total # of hits	Mean # of hits/course
Number of students	33,541	87.1
Home Page	1,788,215	4644.7
Content Pages	975,885	2534.8
Articles Read	3,588,333	9320.3
New Posts	12,308	32.0
Follow Ups	36,082	93.7
MyGrades	148,987	387.0
Assignment	57,713	149.9
Quiz	188,507	489.6
Calendar	50,951	132.3
Mail	32,291	83.9

Table 5 displays tool use data derived from semester 1, 2006, using the geometric categorisation. Each row will be discussed separately. Since the Home Page is the normal point of entry to WebCT, leading almost exclusively to other tools, it is understandable that the majority of students would access the Home Page. In fact, only nine courses were not accessed at all. Of the others, in 12 courses Home Pages were accessed more than 128 times on average, while the largest category (106) was accessed from 32–64 times. Similarly, access to course materials through Content Pages was high and relatively evenly distributed. However, Content Pages were not used at all in 69 courses. These were from areas where staff provide content to students through other means than HTML, for example by downloadable Word and PDF documents. It is, however, apparent that WebCT is used extensively for delivery of content.

Table 5: Distribution of average usage rates of most widely-used WebCT tools for Semester 1, 2006 at Murdoch

Range	0	>0 <=1	>1 <=2	>2 <=4	>4 <=8	>8 <=16	>16 <=32	>32 <=64	>64 <=128	>128 <=256	>256
Home Page	9	0	5	8	22	50	92	106	81	12	0
Content Pages	69	13	10	21	45	64	55	78	29	1	0
Articles Read	95	18	13	17	27	34	46	64	36	25	10
New Posts	114	242	19	9	0	1	0	0	0	0	0
Follow Ups	132	190	37	16	8	1	1	0	0	0	0
MyGrades	244	3	5	11	59	44	19	0	0	0	0
Assignment	346	0	0	5	6	7	10	7	4	0	0
Quiz	330	7	2	6	7	12	12	6	3	0	0
Calendar	86	143	96	41	13	4	2	0	0	0	0
Mail	333	11	10	7	9	8	5	2	0	0	0

WebCT distinguishes three types of activity within the Discussion Forum: reading articles, replying to articles in a thread (Follow Ups) and composing articles in a new thread (New Posts). Articles were read in 290 courses (75%) and there was a relatively even spread of usage patterns. In 10 courses, students read on average more than 256 messages each. The median value was for students to read between 32 and 64 messages. Students have a strong appetite to read messages on the Discussion Forum.

Students contributed new discussion threads in 271 courses, but in all but 10 courses, there was an average of less than one new post per student. In only one course did students contribute more than 8 new messages. In a course designed from a social constructivist perspective, learning activities would typically require a *minimum* of one message per week per student. In an active class, much higher posting rates would be expected. Table 5 shows that only one course came close to this figure. Overwhelmingly, students do not seem to contribute in large numbers to the Discussion Forum. However, the ten courses with moderate rates of posting (>2 posts per student) ranged across all areas of the university, with class sizes ranging from 7 to 199, and from second year to Master's level.

It is apparent from Table 5 that substantially more articles are read than posted. This is logical, in that in a class of N students, each message posted ideally should be read by N-1 other students. In a class where each student posts M messages, the theoretical maximum number of articles read is M x N x (N-1). If not all messages are read, or if the class is divided into self-contained groups for discussions, then the number of articles read will be less than this number, assuming there is no re-reading of articles.

The average number of articles read per course was 9,320.3 (See Table 4). The average number of new articles posted was 32 per course, and the average enrolment in each course was 87.1. The theoretical maximum number of articles read should be 32/87.1 x 87.1 x (86.1), i.e. 2,753.1. However, the average number of messages *actually* read was 9,230. Assuming that each message was only read once by each student, and understanding that WebCT CE4 does not currently record messages posted by course Designers, one can deduce that lecturers contributed the majority of messages read by students.

Follow Ups to existing threads were more common than New Posts, with students in 63 courses contributing more than one response on average. The average number of Follow Ups per student over all courses was approximately one. However, more than eight responses were posted per student in only two courses. Once again, students seem to be passively reading what is posted, without contributing their own ideas or engaging in discussion about unit content.

The MyGrades tool was used substantially in approximately one third of cases. This tool has been promoted within the university as an efficient way for lecturers to inform students about their results. The assignment submission tool is only used in 39 courses, primarily in the School of Information Technology, because the university is still grappling with issues related to electronic marking. The Quiz tool is used in 48 courses, largely to support a suite of information literacy courses. However, the heaviest use is for ongoing formative assessment in several science units.

The Calendar tool was used to some extent in 156 courses. However, it was used more than eight times in only six courses. The nature of the Calendar tool is that it should be used at least weekly, so average use should be 13 per student in all courses which use the Calendar tool. It is possible that the Calendar tool was not well populated by lecturers, and students stopped visiting it when they found it contained no useful information. Anecdotal evidence is that lecturers find it tedious to enter data into the Calendar. The Mail tool was used relatively infrequently, but it is used quite heavily in those courses which provide this tool. These courses tend to use the Mail tool instead of the Discussion Forum tool, reinforcing the view that WebCT is used primarily as a mechanism for teachers to communicate to their students.

Trends in Murdoch usage data

The approach described in this paper was first developed in 2004, and three years of data are therefore available for analysis of trends in usage. To enable data to be compared across the different numbers of students and courses active in each year, an average use per student was calculated for each tool, as shown in Table 6. That is, the total number of hits of each tool (Table 6) was divided by the total number of students in courses for each tool.

Table 6: Average tool use per student during the years 2004-2006 at Murdoch University

Range	2004	2005	2006
Home Page	41.1	43.2	53.3
Content Pages	15.7	23.1	29.1
Articles Read	24.2	62.8	107.0
New Posts	0.3	0.3	0.4
Follow Ups	0.4	0.5	1.1
MyGrades	2.2	3.8	4.4
Assignment	1.2	1.1	1.7
Quiz	2.0	4.4	5.6
Calendar	1.0	1.3	1.5
Mail	0.9	0.7	1.0

Table 6 shows that average use of the Home Page per student has increased since 2004. In other words, students are visiting WebCT more often. This implies that they are looking for, and perhaps finding, more valuable information.

The situation with respect to Content Pages is more complex. Use of this function has clearly risen since 2004. However, analysis of the geometric distribution of use of this tool (cf. Table 5) across each year showed two different trends. Figure 1. displays the variation in use visually, where each distribution has been scaled as a percentage of the total. It is apparent from the left side of Figure 1, that substantial numbers of students did not use Content Pages at all in 2005 and 2006, and this number had increased markedly since 2004. This could be because their lecturers are no longer maintaining both Word and HTML versions of course materials, and instead are letting students download Word or PDF documents. However, other students, towards the right of Figure 1, are making heavier use of Content Pages.

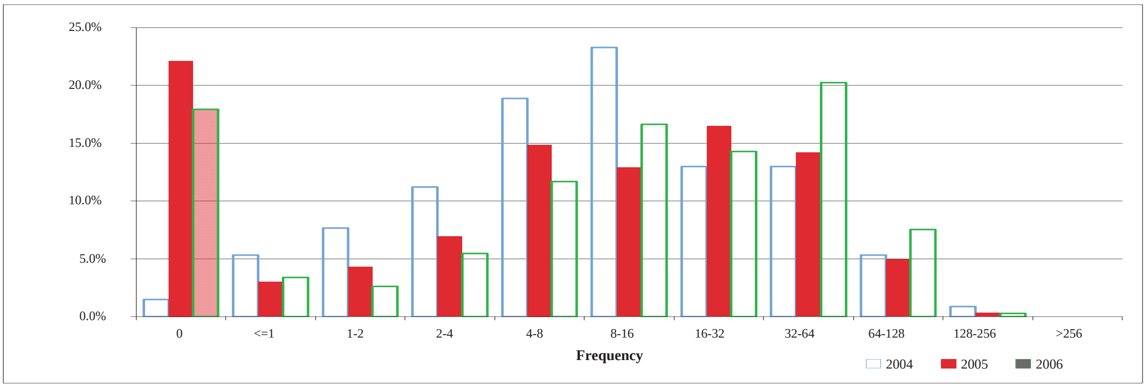

Figure 1: Trends in content page usage since 2004

Table 6 shows that there has been a fourfold increase in students reading articles on the Discussion Forum since 2004. However, usage patterns for Original Posts are largely unchanged, implying that the Discussion Forum is used increasingly by lecturers to post notices to students, rather than for learning purposes. There has been some increase in Follow Up posts by students, indicating that students are starting to engage in a dialogue with their teachers and other students.

A doubling in use of the MyGrades tool has occurred since 2004, as it has been promoted by the university. Similarly, Quiz use has almost tripled since 2004. However, use of the Assignment, Calendar and Mail tools has been largely unchanged over the period.

Comparison across other institutions

It is possible that Murdoch's patterns of use of WebCT tools is idiosyncratic, and other institutions have very different patterns of usage. This possibility will be explored in this section by comparing patterns of usage across several institutions. The webpage describing the course usage analysis script[ii] asks users to contribute their data as part of a benchmarking exercise. To date, four institutions have contributed data. Three are Australian, referred to as Oz1, Oz2 and Oz3, while the third is from the US, referred to as US1.

Oz1 was established in 1966. It is a comprehensive, city-based university with over 15,000 students, four faculties and 20 schools. Oz2 was established in 1967. It is a comprehensive, city-based university with over 30,000 students, one third of whom are postgraduates. Oz3 is a capital city-based former College of Advanced Education which gained university status in 1990. It has 10,000 students, three divisions and 10 schools. US1 has more than 7000 students in the southern United States. It is a regional campus of a state system university. US1 is known for its strong science/technology programs with local ties to NASA (aerospace) and U.S. Army research projects.

Table 7 shows the average number of hits of each tool per student, aggregated at each university over all courses. Overall, the trends are fairly similar at the different institutions. The average Home Page hits provide a measure of the overall intensity of use of WebCT. Murdoch's use is greatest, just ahead of Oz2, with Oz1, Oz3 and US1 indicating similar usage rates approximately two thirds that of Murdoch. The same ranking is apparent for Content Pages, with Murdoch students accessing online content at a rate 7 times that of US1.

In terms of the discussion tools, Murdoch students once again have the highest level of activity in reading forum articles. However, the rates of new messages and replies to threads are similarly low at each institution. The MyGrades tool is used most heavily at US1, with Murdoch second. The other Australian universities use the MyGrades tool less frequently. The US university is the highest user of the Assignment submission tool, which is used less frequently at the four Australian universities, with Oz1 being substantially lower. This is also the case for the Mail tool, with Murdoch using this tool much less frequently that US1. The Quiz tool exhibits an opposite trend, with higher usage rates at Murdoch, Oz1 and Oz2. Use of the Calendar tool is similarly low at all five universities.

Table 7: Average tool use per student at five different universities

University	Murdoch	Oz1	Oz2	Oz3	US1
Home Page	53.3	35.1	50.9	35.5	31.3
Content Pages	29.1	9.3	18.2	14.7	4.2
Articles Read	107.0	58.3	65.7	23.9	28.7
New Posts	0.4	0.3	0.4	0.3	0.3
Follow Ups	1.1	0.7	0.9	0.5	0.5
MyGrades	4.4	1.4	1.2	2.1	5.7
Assignment	1.7	0.3	1.0	1.5	3.9
Quiz	5.6	4.5	4.1	2.0	2.7
Calendar	1.5	0.5	0.6	0.8	2.0
Mail	1.0	3.2	3.6	3.5	6.5

Discussion

The research question that this work investigated was the extent to which the various WebCT tools and functions are used in individual units of study at five universities. Subthemes were the type of pedagogy in use at Murdoch, whether the LMS influenced the pedagogy and how well the use supported WebCT's claim that their product is student-centred.

The results clearly indicate that WebCT is heavily used at each university. Two tools are used extensively: Content Pages and the Discussion Forum – but the latter is used overwhelmingly for students to read information posted by their lecturers. The My Grades, Assignment Dropbox, Quiz, Calendar and Mail tools were used to a moderate extent, but others were used minimally.

Phillips (2004; 2005b) has identified four design dimensions of e-learning, based on the interactions that a student may have in a technology-supported learning environment, between student and student; student and teacher; student and resources; and student and computer.

The evidence at Murdoch University is that the interaction between student and resources is very strongly represented in the online components of the blended learning environment. There is little evidence of online interactions between students and other students, except in a small number of courses. There is however, evidence of interaction between teacher and student, with substantially less, but increasing, reciprocal interaction between student and teacher. No evidence is available from the data about the interaction between student and computer. The situation at the other three institutions studied is similar, but with even fewer student–student and student–teacher interactions.

It is not necessary, nor always feasible, for all four interactions to be present in a learning environment. Indeed, in a blended environment, student-teacher and student-student interactions are likely to take place face-to-face. Nevertheless, there is a strong and growing literature about effective educational practice, based on a broadly constructivist pedagogical philosophy, with a student-centred rather than a teacher-centred approach to teaching (Phillips, 2005a). The evidence here, on the other hand, points to a consistently teacher-centred online environment. Survey research by the Australian Technology Network universities (Platts, 2004) supports this conclusion, indicating that staff feel that a Learning Management System *"is efficient in making* materials available to students; [and] enables teaching staff to give timely information to students" (:4). This work also found that "Most units offered via online learning do so only for purposes of information to supplement face-to-face teaching and learning. They use only about one-third of the capabilities that online learning systems provide." (:4).

On the face of it, this work confirms Cuban's (2001) finding that educational technology is being used to replicate existing practice rather than being used in new ways. This research is not able to determine whether face-to-face teaching practice has changed as a result of content being available online to students. Anecdotal evidence indicates that some staff *may* have changed their approach because there is now less need to deliver content to students in lectures. However, this work and earlier usage tracking work (Phillips, Baudains, & van Keulen, 2002) indicates a strong demand from students for more interactive content. They are certainly reading articles and viewing calendars, and, to a certain extent, they are posting and replying to forum messages. However, there is also evidence (such as in the low use of calendars) that students are not finding what they are looking for in the interactive tools, because their lecturers are not using them well.

It is reasonable to ask why WebCT usage is like it is at Murdoch[iv]? Three reasons can be identified.

The wrong message has been provided centrally
Murdoch's flexible learning initiative (http://www.murdoch.edu.au/admin/cttees/flic/) was predicated on a move from modes of delivery to flexibility of access, and this was embedded in the Murdoch strategic plan[v], with a performance indicator of 95% 'conversion' required by 2007. This initiative evolved into a focus on delivery of content, because a core task was to make existing print-based resources available online. A second, related initiative was the implementation of the iLecture web-based lecture recording system. Both of these initiatives encouraged replication of existing teacher-centred practice.

Inadequate staff development
When WebCT was first adopted at Murdoch (1998–2000) project funding provided staff development on both pedagogical and technical issues related to online learning. However, from 2001–2004 the University had no academic staff development position, and the focus of any professional development was purely technical. This period overlapped the flexible learning initiative, and, consequently, no guidance was available to staff about alternative pedagogical approaches to the use of WebCT.

Staff are time poor
The third reason that WebCT use has been teacher-centred is that staff are increasingly busy. They have no time to invest in learning new approaches which have been mandated centrally without any individual support or rewards. A related factor is that WebCT is too hard to use for many staff. The decrease in the use of Content Pages and the poor use of the Calendar tool indicate that WebCT corroborate this. Many staff resent having to learn HTML authoring skills, and the need to maintain duplicate copies of documents in both Word and HTML format is onerous to staff.

Conclusion

This paper has provided evidence that a teacher-centred pedagogy is in use at each of the five universities represented in this study, and there is little support of WebCT's claim that their product is student-centred. It is difficult to say whether it was the LMS or other factors which influenced the pedagogy adopted, but the fact that all five universities had similar usage patterns provides some evidence that users' perceptions of the functions of the LMS influenced their pedagogy.

It costs approximately $A250,000 per annum to run WebCT at Murdoch, and it is prudent to attempt to make the best use of that investment. This appears not to be the case at present, where the major WebCT functions used (providing content and notices from lecturers) could be provided almost as well by an FTP server and email, at much lower cost.

Furthermore, the current use of WebCT is at odds with a key strategy of the educational goal of Murdoch's current strategic plan *"To provide a student-centred learning environment for all students"*. While 'student-centred' could be interpreted more broadly than the concept has been treated here, it would be advisable for Murdoch, and other universities promoting student-centred learning, to reassess whether the way they are using their LMSs are consistent with their strategic directions. The same could be said of LMS providers, such as Blackboard.

This paper has shown that WebCT usage logs can be used to inform policy makers and educational development units about the success of curriculum improvement initiatives. They can also be used by educational designers and staff developers to identify courses with inappropriate use of tools, and to identify exemplary courses which can be highlighted to other staff.

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[i] The term 'unit of study' or 'unit' will be used to describe a semester long programme of study on a single subject. The term 'course' will be used to describe a WebCT instance associated with a unit of study.

[ii] A more detailed description of the algorithm and the software is available at http://www.tlc.murdoch.edu.au/project/webct/tool_use_analysis.html

[iii] Tables 2 & 3 display data from 2004, when the prototype analysis was performed with 339 WebCT courses.

[iv] The research design did not allow closer analysis of the wider context at the other universities.

[v] https://www.murdoch.edu.au/admin/strategicplan/

Repurposing an online tutor training resource

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This paper presents a reflective case study that illustrates the challenges associated with repurposing, for the human health sciences, an existing high-quality staff development and tutor resource website originally developed by the Faculty of Veterinary Sciences at the University of Sydney. The discussion focuses on the experience of negotiating, planning, and executing repurposing the site for staff development and tutor support in postgraduate programs offered by the Faculties of Health Sciences and Medicine. Benefits and challenges associated with repurposing this resource within the same overall university context are considered.

Keywords: elearning, reuse, repurposing, online tutor training, health sciences

Background

Close examination of the educational literature on reuse of digital resources reveals little of individuals' 'lived' experience of reuse (e.g. Littlejohn, 2003). This paper presents a reflective case study of a repurposing project within a large, conventional research-intensive university. We report on the challenges faced, the processes used, and reflect on our experience in this repurposing project.

Many degree courses offered in flexible delivery mode in a university setting provide an orientation to online teaching and learning program for their tutors. At the University of Sydney, this has been a somewhat discrete and individual activity. Yet, not withstanding the obvious disciplinary and contextual differences between degree programs similar orientation concerns and quality control issues need to be addressed. Given this common focus, in 2006 we embarked on the process of repurposing an online resource for orienting tutors to online tutoring originally built and refined by a different faculty (Veterinary Science) with the goal of supporting online tutors in postgraduate courses in the Faculty of Medicine and the Faculty of Health Sciences. This resource, VetTeach, falls into Duncan's highest level of aggregation category: 'collections of assets which include the educational context and support for educational activities' (2003, p.15) and Koper's middle level of reuse: 'something created by someone else within the same community or organisation' (2003, p.48).

Discovery

VetTeach would have been 'under the radar' if not for its recognition within a broader strategic development project, the College of Health Sciences eLearning Resource Centre (ERC) (Mahony & Wozniak, 2006). VetTeach was reported as an example of a good practice site in the ERC (Pizzica was then an educational designer on the ERC project and Mahony the project director). Subsequently, the ERC was reported at the 2005 ODLAA bi-ennial Conference. When the Conference organisers placed a paper on VetTeach (Laxton, Forsyth & Toribio, 2005) in the same session with one on the ERC, Mahony's knowledge of VetTeach was extended and Devonshire, in attendance at the Conference, was introduced to VetTeach. Shortly thereafter Pizzica, Devonshire and Mahony all independently approached the subdean for postgraduate coursework in the Faculty of Veterinary Science about migrating VetTeach to a human health sciences context. Advised of this by the subdean and given our shared interest, we formed a collaborative team to negotiate access, plan for and then repurpose the site, for use to support online teachers in the medical and health sciences as HealthTeach.

The challenges of repurposing the tutor resource

VetTeach was developed for delivery as a modularized WebCT site, supported with a single face-to-face workshop and selective coaching where needed. Following implementation, informal evaluation indicated that it provided a successful professional development activity for supporting teaching practice. It also proved to be an efficient and sustainable use of resources within the degree course (Laxton et al., 2005).

The key repurposing challenge was how to redesign the resource to accommodate an expanded range of disciplinary and course contexts, yet still maintain its course-specific (purpose built) nature. The repurposed resource was to be used in multiple teaching environments in which there would be an increase in the number of tutors accessing the resource, the discipline areas covered would change (from veterinary science to multiple fields in the human health sciences), and there would be differing participant communities and course goals (e.g. ranging from primarily physicians in professional Master of Medicine courses to a mixture of health professionals in the Graduate Studies Program in Pain Management and the Graduate Program in Sexual Health). There were also differences in how HealthTeach would be integrated with tutor support plans and professional development activities across the different course contexts. Similarities with the Veterinary Science context included use of tutors in professional practice outside the university and the potential for both students and tutors to be located anywhere on the globe.

The success of VetTeach had been identified as, in part, due to its context-specific nature, with many examples related to specific veterinary science practice. Another factor was sensitivity to the needs of the tutors and to the teaching ideology and focus of the courses in which the tutors would be working. Thus, one of the risks in repurposing and extending the program was that this specificity would be lost and its efficacy compromised. To be used to support several different degree programs HealthTeach might necessarily become too generic to provide the specific targeted support needed by tutors whose expertise in their subject matter was clear but whose teaching experience was limited. In the new context, tutor expectations and responsibilities might also vary from course to course. Cox, Clark, Heath, & Plumpton (2003), for example, characterize tutors' roles according to facilitation and moderation of discussion activities and focus on the tutor's role in facilitating the process of knowledge construction and integration in students. Denis et al. (2004), however, describes roles of the tutor from the perspective of the tutor's interactions with students, identifying many different roles according to whether they are Central (related to interaction) or Peripheral (occurring prior- or post-interaction) and reflecting a range of necessary competencies (pedagogical, communicational, discipline expertise and technological). The transformation needed could not simply be editorial.

The repurposing activity

Given our combined interests, we approached this as a single project rather than each working separately to repurpose the resource for our own more specific needs. From both an individual and an institutional perspective there were obvious benefits with this approach. It was cost-effective in that it utilised an established and proven resource. It also combined staff talents and available resources across the institution, to deliver a consistent and professional approach to tutor training within our faculties. Yet, in spite of these benefits there were a number of challenges that had to be addressed. One was how to present the site to the end user so that it appeared purpose built and specific enough to meet individual needs. Another was to repurpose the site so that it could accommodate different delivery needs, ranging from integration into a structured orientation program through to a more ad hoc, user driven approach (i.e. accessed on a 'need to know' basis).

Meeting these challenges required:

- negotiating permission from the Faculty of Veterinary Science to use and repurpose the site
- identifying the likely variations in participants, context and use for HealthTeach

- sharing the review and revision task in the light of the above context (web pages were prepared as Word documents so that revisions could be identified by using Track Changes and Comment)
- developing human health sciences examples which were authentic and relevant for a range of professional contexts/specialisations (e.g. ethical considerations)
- including in the design a course specific module to take account of pedagogical specifics and local policies
- reviewing as a group the above, with discussion about all points of difference until agreement reached
- implementing the changes on the website
- editing, reviewing and sign-off of the HealthTeach website

Another important consideration in terms of the long term viability of the site was developing a management plan for updating and maintaining the resource in our devolved university environment.

Meetings were held in person and by audio-teleconference, as we are located on three different campuses of the University of Sydney. During the exercise we identified, experienced and resolved a number of issues:

- terminology differences were clarified to ensure consistency in application throughout the resource
- differences in course expectations of tutors were discussed and the resource repurposed to accommodate the different contextual needs
- differences in perceptions of tutors' commitment and interest in accessing and engaging with the support materials
- the importance of restricting changes to only those that were necessary and sufficient, to minimise cosmetic changes and to contain the workload involved
- the need to refine the design to enable course-specific information to be provided in a consistently structured manner (the introduction of a course specific module)
- other issues such as differences in rhetorical approaches and individual work responsibility timetables.

Reflections

Fortunately, from the beginning there was agreement about the challenges of repurposing the resource for multiple contexts, despite our common human health sciences focus. We shared similar philosophies of learning and teaching and were already known to one another. This meant that we could from the onset focus primarily on our task; the need for attention to team building to aid collaboration was not ignored, however, and should always be given due recognition in such circumstances.

We began with a resource which we all respected and considered of high quality. Even in these circumstances and in the framework of an agreement to make only necessary changes, the review process made visible the differences in academic context and culture in which each of us worked, as well as varying personal preferences. It is possible that if each of us had repurposed VetTeach separately there would have been a greater number of changes though not necessarily substantial ones. In our team environment the default became no change if there was not agreement to the change. This approach, based on a common/ collaborative ownership of HealthTeach, controlled the tendency to make cosmetic changes.

VetTeach was located in the technological environment in which we wished to place our repurposed version: WebCT4 centrally managed in the University of Sydney. Thus, we had few information technology infrastructure challenges to surmount, and could focus on pedagogical design and content. While we did not initially forecast the total hours we expected this project to take, the work has probably taken longer than expected. This emphasises the importance of allocating enough time for review, revision, and in our case negotiation across multiple contexts.

At the time of writing HealthTeach is close to release for use in our varied environments. While we are confident that we have reached a satisfactory design balance between the specific and the generic for this multiprofessional human health sciences online tutor training resource, this achievement can only be confirmed when feedback from course team members is received.

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Learning from Web 2.0 practices: A tool to support real-time student collaboration

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This paper describes the conceptual design of a prototype tool, currently in development, that facilitates productive collaboration in a synchronous environment. The tool could be used to bring the benefits of a tutorial to lecture and online environments. The design and development is based on successful Web 2.0 practices, and its use is considered in terms of an interpretation of Laurillard's Conversational Framework.

The outcome of the development project is a generic tool that enables a shift of some facilitation activities from a learner-teacher mode of delivery to a learner-peer supported network. Suggested uses of this tool are discussed including tasks involving analysis, synthesis and evaluation. Finally methods to integrate the tool into assessment processes are presented.

Keywords: learning communities, collaborative learning

Background

While contemporary students and teaching strategies have changed, there is much evidence that a deep approach is not taken for all students, all the time – particularly with 'traditional' university teaching (Biggs, 2003). With the shift to student-centred learning approaches and a move to blended learning environments, learning design needs to be informed by more contemporary approaches to teaching and supported by appropriate tools. Laurillard's Conversational Framework is based on the premise that dialogue between students and teachers is key to reaching a shared understanding (Laurillard, 2002). The one-to-one tutorial model proposed may represent an optimal environment to foster learning as a conversation but it is not a practical option. Online communication tools provide one way to support dialogue between teachers and students, however traditional delivery approaches for lecture and online environments are still dominant forms.

Web 2.0 is a multifaceted term that describes the 'second generation' of web services that are becoming available online (O'Reilly, 2005). Digg.com is an example of a user-driven site based on the ideas that define Web 2.0. It provides a structure and process for an ad hoc community to quickly generate and discuss material, and come to a consensus on which contributions have value to the community. Web 2.0 services are the force behind 'social software' such as Wikis, which facilitate the collaboration and sharing of information, for example websites such as eBay, Wikipedia, and Flickr (Wikipedia, 2006). These technologies encourage a change in practice for structuring and selecting web content, in place of the original page metaphor (Alexander, 2006). This encourages a community to selectively participate, actively or passively, in the generation and selection of content and discussion of this process. This process is facilitated to a degree, but is mostly driven by user interest and filtering (Macgyver, 2006).

Where appropriate to the task, collaborative learning provides an alternative to traditional teaching and learning approaches, with peers supporting each other in their learning. Group work provides students with an opportunity to engage in discussion about theory and ideas, to develop a shared conception of the subject, and collaborate on the application of this knowledge. Collaboration involves interaction, verification, consolidation, improving mental models and engages critical thinking and problem solving skills to arrive at a shared outcome (Ocker & Yaverbaum, 2001). Research into the benefits of collaboration in traditional face-to-face learning environments has shown that students can experience "better performance, better motivation, higher test scores and level of achievement, development of high level thinking skills, [and] higher student satisfaction" (Cecez-Kecmanovic & Webb, 2000, p.73). Group work encourages a shift in the support and communication load from the teacher to the group, providing the learner with an opportunity to engage in a model of problem solving that better reflects the demands of the real world (Bennett , Harper & Hedberg, 2001). Students participating in online group work can experience the benefits of face-to-face group work and these benefits can be enhanced through adequate technological support (Cecez-Kecmanovic & Webb, 2000).

This paper outlines the conceptual design of the prototype of an online tool that facilitates productive collaboration in a synchronous environment. It is based on successful Web 2.0 practices and mapped to an interpretation of Laurillard's Conversational Framework. Through rethinking pedagogical approaches for collaboration in an online environment, together with the technological approaches afforded by Web 2.0, it is hoped that this tool will encourage better framing of online collaborative activities. It aims to do this by providing students with support in tasks that encourage productive outcomes, engage higher order thinking skills, and open up the learning activity to more of the steps of the Conversational Framework.

Design

In an analysis of the design of online collaborative learning, Reeves, Herrington and Oliver (2004) reported that a major drawback of the environment is that traditional face-to-face pedagogical approaches continue to be applied. Many academics and other specialists involved with converting traditional courses into an online format do so without pedagogical change. Laurillard (2002, p. 86) argues that there are four processes that are essential for most types of academic teaching for learning. They are:

1 Discursive process – involving dialogue between teacher and student about their conceptions;
2 Adaptive process – thinking, in light of the discursive process, about the adaptations of the task goal by the teacher and adaptations of actions by the student;
3 Interactive process – representing activities that the teacher and student undertake within task environment;
4 Reflective process – reflection by both the teacher and the student on the interactive process.

Different technologies are a better platform for some of these processes than others. While online discussion forums and chat rooms can engage students in a conversation between students and teacher, and students and their peers, the successful use of these tools relates to how the learning activity is framed. This is crucial if online communication tools are intended to provide students with the opportunity to interact in an environment that encourages the development of higher order thinking skills and/or to apply their understandings (Reeves et al., 2004).

Part of the 'core' intent for Web 2.0 companies is: 'trusting users as co-developers and harnessing collective intelligence' (O'Reilly, 2005). In teaching and learning, this can be equated to valuing and supporting peer learning and assessment. Peer learning encourages students to take responsibility for their learning and deepen their understanding of the content associated with the activity (Boud et al., 1999).

The processes of collaboration (interaction, verification and reflection, and consolidation to arrive at a shared outcome) that is possible in the real-time environment of a tutorial can be mapped to the following synchronous online tools: chat, rating and group editing. However, with current tools, this typically requires multiple windows or tools to display the features: chat windows, rating controls and group productive spaces. For students, this is a complex user interface. This prototype simplifies the design into one window by reproducing the features as a sequence of steps in the collaborative process. This use of steps provides scaffolding for students through the collaboration process.

The steps in the collaborative process and the features used in each step are represented diagrammatically in figure 1. They are:

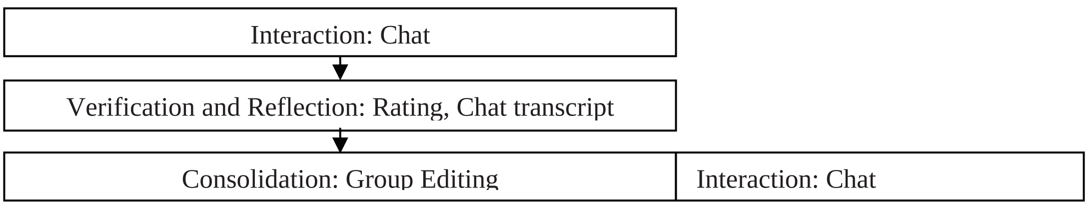

Figure 1: Collaborative process mapped to learner activity

1 *Interaction.* In this stage the students come to a shared definition of the learning activity and work towards the activity outcome through discussion, development, critique and defence of ideas. The step provides learners with opportunity to enhance communication, teamwork, and critical enquiry skills.
2 *Verification and Reflection.* The students then identify and rate the discussion entries from the chat transcript that best address the goal. This step provides learners with an opportunity to individually reflect on the group discussion. The outcome is a cumulative selection of the positively rated entries by the group for the consolidation step and a prompt to learner to reflect on the group's selection – in particular how it differs from their own selections.
3 *Consolidation.* The highest rated entries from the discussion are automatically added to the group edit area – representing the first draft of the activity. Students can then collaboratively consolidate their discussion into a single text and identify any outstanding questions.

Once the consolidation step has been completed the teacher reviews the document to ensure that the students are on track and addresses any questions raised as well as giving feedback. If this cannot be done immediately, it could be provided online at a later time or as part of a face-to-face tutorial. The students could then have the opportunity to make changes to their document and the document could be published for others to view. In addition to the document itself, this could include the feedback from the teacher and the activity logs.

A series of complementary activities would enable the teacher to ensure that all interactions in the following adaptation of Laurillard's Conversational Framework were met by including interactions with the group that spanned discussion both discursive and interactive processes. The adapted framework, figure 2, shows how the group takes on some of the responsibility for their learning.

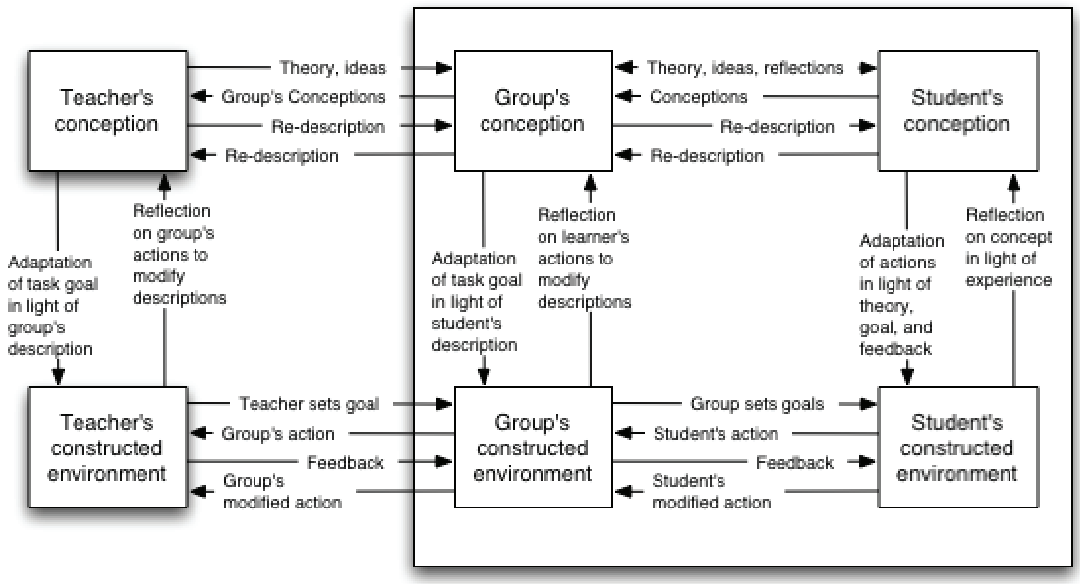

Figure 2: An adaptation of the Conversational Framework to incorporate collaborative learning

Possible applications

Three ways in which this approach could be used to support collaborative learning are:

1 Structured group online reflection activities responding to a streamed lecture or other media or text item (e.g. a case study video). This media could be integrated into the interface in a frameset;
2 A structured group-based or note taking activity used in a live lecture setting;
3 The tool could be used as an open-ended, idea-generation resource and questioning assistant for a group assignment.

In the first two methods, a teacher would typically plan content and a series of activities to accompany the tool, and give feedback to the students' response. Guidelines provided by the teacher for the cumulative peer assessment would provide students with some direction: e.g. 'useful point', 'interesting point', 'relevant question'; or alternatively 'include in the introduction', 'include in the body', 'include in the conclusion' etc. In the third method, the students initiate the discussion points based on their topic.

Assessment models

Assuming that the unit's objectives are measurable through the collaborative tool, (e.g. analysis, synthesis and evaluation) it may be appropriate to allocate a percentage of the unit mark to this activity. For example, the quality of the group outcomes could be marked by the facilitator at the time of contributing feedback, or after improving the document as a result of feedback given. All students would benefit by choosing the best responses via their ratings, as a higher quality group document would be the expected outcome. Alternatively, both the group document and the results of the peer-rated individual contributions could be used. This would reward students whose contributions contributed to first draft of the document, as identified by their peers, and may motivate students to contribute more thoughtfully.

Conclusion

The shift to learner centred teaching can be paralleled with the shift in focus from producers to user groups in successful Web 2.0 sites. The prototype tool under development makes use of the Web 2.0 practices that enable ad hoc networks to productively collaborate in real time. The tool provides a three-step, sequenced online activity to provide support for students engaging in a collaborative task. The process of discussion, selection, and consolidation encourages higher order thinking through idea creation and critique, reflection, and synthesis.

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Supporting peer assessment of individual contributions in groupwork

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The ability to assess the work of others is a core attribute for most professionals. To develop this graduate attribute in our students requires the learning of self and peer evaluation, feedback, and review skills. This paper discusses the changing design of peer assessment and the impact of a new groupwork support tool within a capstone undergraduate subject with large student numbers - Systems Development Project – in the Faculty of Information Technology at UTS.

Since 1998 by implementing different support strategies for peer assessment of individual contributions the distribution of the students marks has markedly widened, and now more reflect the reality of differing team member contributions. This substantial change has occurred with the use of an online tool which supports the development of student evaluation, feedback and review skills when peer-assessing individual contributions to large group projects. In use since 2004 the groupwork support tool is called Team Contribution Tracking (TeCTra).

Keywords: designing peer assessment, online learning support, developing graduate professional attributes

Introduction

In many disciplines higher education courses include significant capstone subjects involving projects that require large student teams. When facilitating peer assessment with a holistic approach (Schechtman, 1992; Schechtman & Godfried, 1993) the common assessment strategy for groupwork of allocating the same or almost the same mark to all team members (Rosen, 1996; Lejk & Wyvill, 2001; Kennedy, 2005) is not adequate as the project tasks are extensive, the teams are large in number (more than 4 members), extend for the whole semester and groupwork can constitute 100% of the final student assessment. The subject coordinator has limited opportunities to observe and assess the complex group and teamwork dynamics that are taking place. A peer-assessment strategy is required which is ideally formative, diagnostic and summative (Goldfinch, 1990; Gatfield, 1999). This ideal has been difficult to achieve (Lejk & Wyvill, 2001; Li, 2001) and remains as an important and unresolved feedback and assessment issue.

Peer assessment has been shown to support not only students' learning but also improve their understanding of the assessment processes themselves (Bloxham & West, 2004). Peer assessment is also required to assess individual contributions to group assignments (Johnston & Miles, 2004). The development of the evaluation, feedback and review skills required to peer assess these complex teamwork processes is a key learning objective of such large project-based capstone subjects. These are skills every professional should possess and be able to use for different purposes. It is also important for the novice professional to experience being on the receiving end of peer-reviews and assessment and to learn to benefit from any feedback received.

Peer-assessment for assessing individual contributions to groupwork is controversial not only because it can produce 'unreliable' results caused by the inexperience of the student assessors and often by rather undifferentiated marks (Kennedy, 2005). Also the labour intensive processes the subject coordinators have to administer are problematic (Clark et al., 2005). This paper addresses these concerns and presents a peer-assessment strategy and online tool for the peer-identification of students' individual contributions in a large groupwork-based capstone subject in software system design.

The presented learning and teaching strategy and online tool requires the students to rate and comment on each other on a weekly basis. This task is informed and supported by evidence of the work done and outcomes achieved by each student. The strategy creates a formative, diagnostic and summative assessment environment in which the students can learn the skills of peer-assessing their peers using quantitative ratings and qualitative comments. This peer-assessment strategy has delivered greater differentiation of student marks than those reported in the literature and experienced by the authors in the period before the introduction of the TeCTra online tool. The online tool and system for data collection, presentation and calculating contribution factors has released the subject coordinator from the enormous work otherwise required to process any similar paper-based strategy.

Subject description

Systems Development Project (SDP) is a capstone subject in the Bachelor of Science in Information Technology at UTS with 350-400 students each year. The degree has three years of course work and a year of industry training. SDP is taught in the second semester of the second year and aims to prepare the students for industrial training in the third year. Before undertaking SDP the student has completed three semesters of IT education in programming, systems design and development, networking and information systems. During SDP the students experience working in a team and learn how to apply their prerequisite knowledge to a practical system development problem. During the project they develop a system from specifications to a working software product.

SDP involves groups of 10 students in a major project that takes 50% of their study time (12 credit points) for a full time student for one semester of 15 weeks. Groups have a great degree of autonomy. They are responsible for planning and allocating project tasks and organizing work in the groups. Academic tutors, usually project managers from industry, are subject Project Managers responsible for overseeing the groups' progress and attending to problems with group dynamics and project work.

There are two milestones in the project, a mid-semester review and a final review, and each produces 50% of the final assessment. The two assessments comprise of a peer review (worth 40%) and a staff review that assesses written submissions (60%).

Peer assessment in the project

Students are required to undertake a number of peer-assessment activities. Firstly, they review other groups' work at the two project milestones of the mid-semester review and the end-of-semester final review. Secondly the groups are asked to assess individual contributions to the project made by the team members. This assessment is done formatively and progressively during the semester, and then summatively during the mark allocation of the mid-semester and final reviews.

During the peer reviews each group assesses an oral presentation given by another group. The presentation takes 20 minutes and is followed by 10 minutes of question and answer time. The reviewers make their assessment against a set of given criteria that the designers were to achieve through their solutions. During the presentation each member of the reviewing team does their own assessment of the presented solutions. The group discusses the individual marks and consolidates them into a group assessment which is given to the presenters and accounts for 40% of the total mark. There is a requirement that the marks given to the other group are properly justified and both the advantages and disadvantages of the presented designs are assessed.

The project outcomes as assessed by the peer and staff reviews produce an overall mark for the group effort. This mark is then multiplied by the number of students in the group and the result becomes a pool of marks that the group members must distribute amongst themselves according to their assessment of individual contributions to the project. Guided by instructions given to them in the assessment policies and procedures a meeting of all the team members is convened to discuss the mark allocation. The groups are advised to start the meeting with a round of statements by the team members about their respective contributions to the project. Then through discussion and negotiation the group arrives at an allocation of the marks that all team members can agree on. The results are then presented to the Project Manager, a staff member, for approval. Once the consensus on the mark allocation is confirmed the individual marks are accepted.

Supporting peer assessment of individual contributions

In capstone subjects with large groupwork projects students are often given responsibility to allocate individual marks according to the perceived individual contributions made by each team member. Time and again this responsibility has proved too difficult for the students to dispense properly resulting in an equal distribution of marks irrespective of the actual contributions (Rosen, 1996; Lejk & Wyvill, 2001; Kennedy, 2005; Raban & Litchfield, 2006). As a result, good students are dissatisfied with their summative grade and marks while those students who chose to do very little receive undeserved rewards.

In the SDP capstone subject the groups of 7 to 10 students experienced the same problem. In recognition of this, the students were given an increasing level of support in peer assessment across the 8 years in which the subject has been offered. There are three distinct periods in which peer assessment of individual contributions was assisted in different ways. These are:

- Summative assessment of contributions without on-line support (years from 1998 to 2001);
- Summative assessment of contributions with time recording (years from 2002 to mid-2004); and
- Formative and summative assessment of contributions with time recording and weekly ratings (years from mid-2004 to now).

Development of peer-assessment support was gradual and the results of different approaches closely monitored. The ability to differentiate final marks by the groups was used as a measure of the impact. To make the analysis statistically significant, it was performed only for semesters with 10 or more groups. For each group, a coefficient of standard deviation of the final individual marks was calculated. It was used as an indicator of to what extent the group was able to align marks with individual contributions. For each semester a graph showing the percentage of groups that differentiated their contributions by 0-5%, 6-10%, 11-15%, 16-20% and 21%+ were plotted.

Summative assessment of contributions without on-line support

In the years from 1998 to 2001 the students had to rely on their own records and recollections of individual contributions in allocating individual marks. The only support given to the groups was a set of rules and policies that spelt out a range of good practices for peer assessment. Occasionally groups were not able to reach a consensus and a staff member was called in to break a stalemate in the mark negotiations. It has to be stressed however that the academic tutors would never engage in the actual assessment of contributions. Instead the tutor would assist the group to choose an acceptable method of assessing contributions and then assumed the role of an impartial facilitator of the method's implementation. As a result in semesters Spring 1998, Spring 1999 and Spring 2001, the distribution of peer marks were diversified as shown in Figure 1. Note the thick line that shows the period total and represents the overall trend in the period.

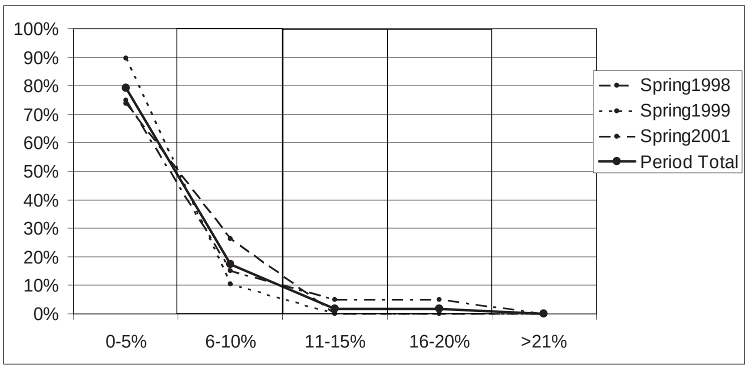


Figure 1: Period with no online support

The graph shows that between 75% to 90% of all groups opted for almost equal mark distribution. It was an expected result in line with similar cases reported in the literature (Rosen, 1996; Lejk & Wyvill, 2001;

Kennedy 2005). This nearly equal distribution of marks was hardly plausible as in groups of 10 students one can expect a wide-range of individual contributions.

Summative assessment with time recording

In the years from 2002 to mid-2004, in order to better support peer assessment of individual contributions the students used an online tool for recording individual time spent on the project. The time records were collected on a weekly basis, stored in the system and made available to all the team members for perusal as in Figure 2. While reporting the hours, the students had to state which task and what type of work the hours were spent on. In Figure 2 the student Jennifer Law spent a total of 15 hours working as a Project Leader and on Requirements Specification tasks engaging in management, development, documentation and quality review.

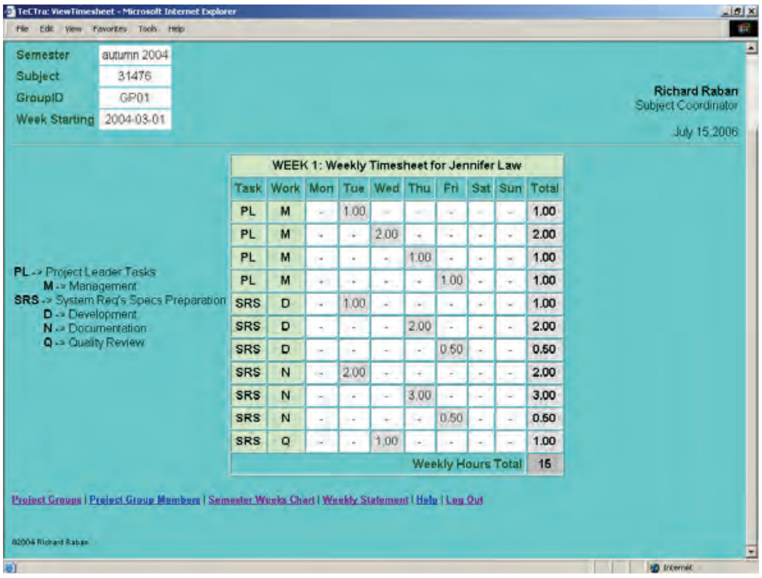


Figure 2: Time records available for peer assessment

The time records made individual efforts visible to the team members and thus could be used to inform the process of assessing individuals. It ensured that all work from early attempts, possibly no longer visible in the final product and easily forgotten, could be taken into account in the summative mark allocation.

As a result of the use of time records in semesters Spring 2002, Spring 2003 and Autumn 2004 the distribution of peer marks were diversified as shown in Figure 3. Note the thick line that shows the period total and represents the overall trend in the period.

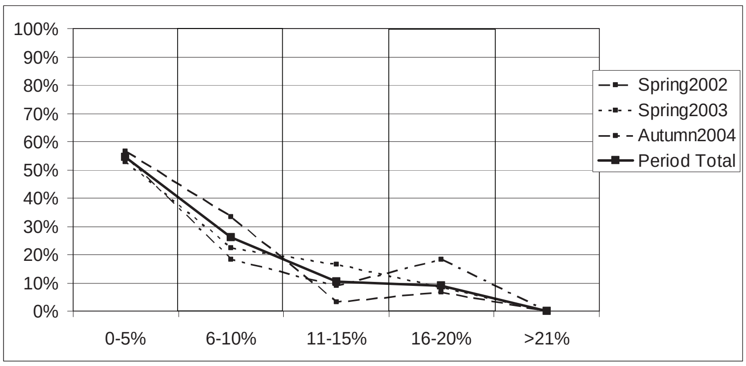


Figure 3: Period with time records available

An analysis shows that the time recording tool reduced from 75-90% to 55% the percentage of the groups electing an easy way out by giving everybody equal or almost equal marks. Providing the students with evidence of who was doing what and how much time was spent on the tasks empowered a greater number of groups to diversify marks. It was an improvement on the previous situation yet the general pattern of most groups was still in the 0-5% band indicating ongoing difficulties with the peer-assessment of individual contributions. In both periods when an holistic summative peer-assessment strategy was used, the results were consistent with those presented by other authors (Rosen, 1996; Lejk & Wyvill, 2001; Kennedy 2005).

Apparently being informed about time spent does not easily translate into peer-contribution ratings as time-records do not take into account the quality of work and the level of participation in leadership, motivating team members or organising team work. The results achieved by (Lejk & Wyvill, 2001) seem to confirm this argument. It was demonstrated that the summative category-based approach to peer-assessment in group projects produced a wider and smoother distribution of individual marks than the summative holistic one. The holistic approach produced a lot of almost equal marks with only extreme cases of over-or-underperformance reflected in mark differentiation. However the likely cause of this mark distribution is the fact that minor differences in contributions are not easy to quantify especially if there is a considerable time-lapse between the work done and its assessment. Only very poor or outstanding efforts seem to be recognised and reflected in the distribution of marks.

Formative and summative assessment with time recording and weekly ratings

In the three semesters from mid-2004 to 2005 the shortcomings of a time-based peer-assessment strategy have been addressed with the design and implementation of an online groupwork tool called TeCTra. The tool facilitates:

- time recording - now with an additional feature to allow recording of deliverables that were produced during the time reported;
- a confidential feedback system that allow team-members to make comments on individual contributions directly to each other;
- ratings of individual contributions that were done on a weekly basis; and
- a progressive calculation of weighted weekly contribution-factors that indicate how the group rated individual contributions on a weekly basis.

Weekly ratings make peer-assessment much easier as the assessed work and group interactions are still remembered by the team-members. It also takes away the stress of summative assessment that contributes a large portion of the final mark and therefore creates a lot of tension within the group. The students can be more honest in making judgements on their peers. Contribution factors calculated for each week and weighted contribution factors calculated for a period of time give quantitative diagnostic feedback to each team member regarding their standing in the group. Additionally, qualitative comments on the work done by team members can be exchanged facilitating formative feedback that explicitly raises groupwork issues with the students. The students are not only given quantitative feedback on their perceived contributions but also receive qualitative feedback on their group work efforts.

Each reporting week every team member was required to rate the contributions of all team members as above normal (3), normal (2), below normal (1) or no contributor (0). This scale is similar to the one proposed in Goldfinch (1994) with the exception of not including a hindrance to the group (-1) rating. To inform the peer-judgement, each week's deliverables and time-spent was displayed as shown in Figure 4. Additionally, each rating could be accompanied by feedback to the person rated indicating perceived problems or good points of their participation. The feedback was only visible to those to whom it was addressed without disclosing who sent it. In Figure 4, the student Bernard Greenspan sent comments to four team members. The feedback to the student Patrick Coble shown in Figure 5 includes Bernard Greenspan's comment without disclosing who sent it. No other student could see the thus confidential comment.

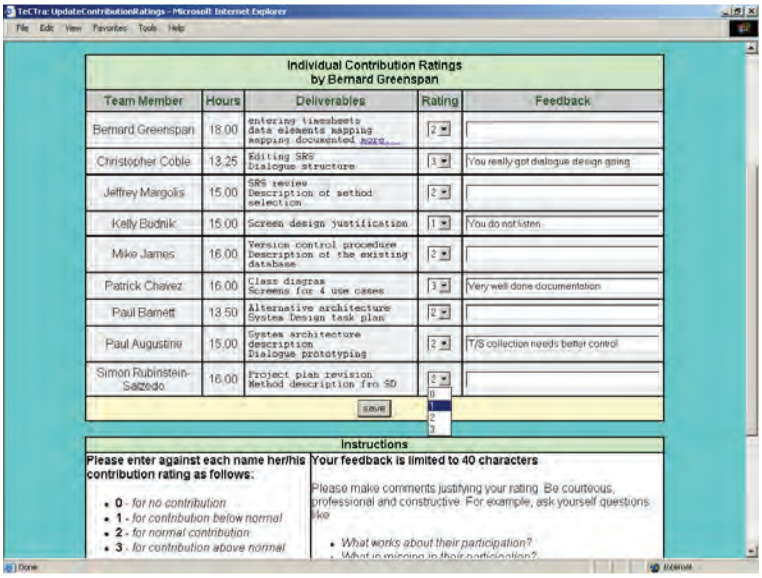


Figure 4: Weekly peer ratings entry screen

In Figure 4 ratings for the week are combined into Weekly Member Contribution Factors of team members. The ratings of each team-member are totalled and an average rating calculated, then each individual total is divided by the average and multiplied by 10. The consequent Weekly Member Contribution Factor reflect the whole group's perception of individual contributions informed by the time records, ratings and comments and also reflects the quality of groupwork.

The Weekly Member Contribution Factors always represent a distribution of a fixed-pool of marks among the team-members so the Factor is indicative of contribution levels. In the subject SDP the pool of contribution points is 10 times the number of team-members. If everybody contributed equally, all team members would have a Weekly Member Contribution Factor equal 10. Therefore, an individual contribution factor below 10 indicates a below average contribution, and a factor above 10 indicates a contribution better than average.

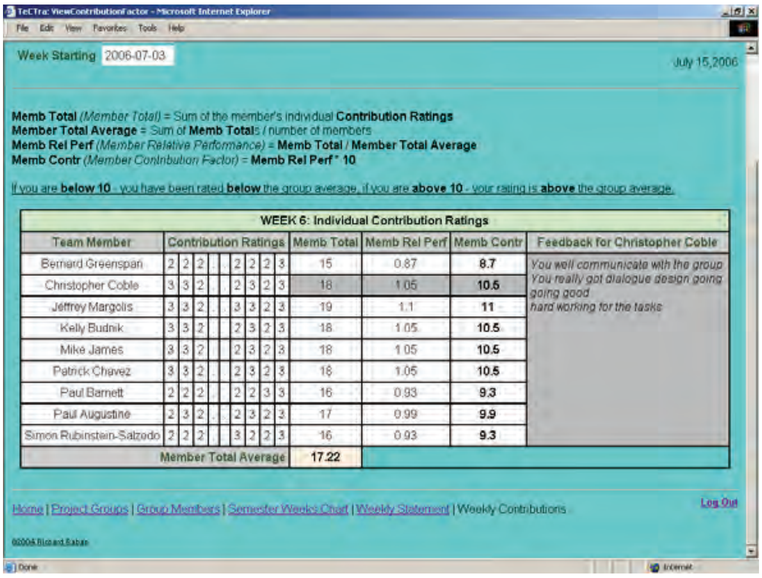
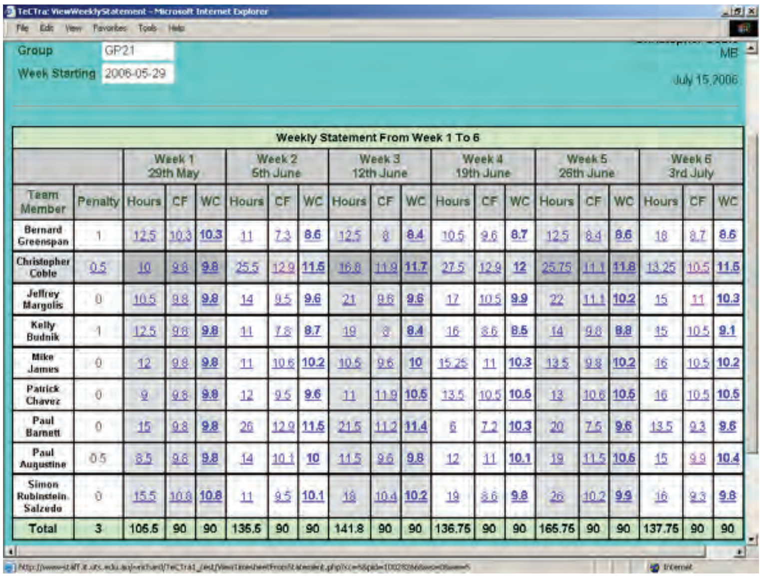


Figure 5: Weekly contribution factors

Time records (Hours column), Weekly Member Contribution Factors (CF) are shown for all team members across all the weeks already reported on (see Figure 6). Additionally, Weighted Contribution

Factors are calculated progressively across the period of time showing the members' standing in terms of contributions for a period of time. In these calculations, Weighted Member Contribution Factors (WC) are weighted by the total weekly hours spent on the project by the team. The rational behind it is that a week with 100 hours spent is expected to contribute to the project roughly half of what a week with 200 hours spent do.

On the screen in Figure 6 Christopher Colbe appears to be the top contributor of the group with a Weighted Contribution Factor of 11.6. This progressive peer-assessment of individual contributions allows team-members to see how their contributions are perceived by the whole group and to modify their interactions with the group in order to improve their rating and standing within the group.



Weekly Statement From Week 1 To 6

		Week 1 29th May			Week 2 5th June			Week 3 12th June			Week 4 19th June			Week 5 26th June			Week 6 3rd July		
Team Member	Penalty	Hours	CF	WC	Hours	CF	WC	Hours	CF	WC	Hours	CF	WC	Hours	CF	WC	Hours	CF	WC
Bernard Greenspan	1	12.5	10.3	10.3	11	7.3	8.6	12.5	8	8.4	10.5	9.6	8.7	12.5	8.4	8.6	18	8.7	8.6
Christopher Coble	0.5	10	9.8	9.8	25.5	12.9	11.5	16.8	11.9	11.7	27.5	12.9	12	25.75	11.1	11.8	13.25	10.5	11.6
Jeffrey Margolis	0	10.5	9.8	9.8	14	9.5	9.6	21	9.6	9.6	17	10.5	9.9	22	11.1	10.2	15	11	10.3
Kelly Budnik	1	12.5	9.8	9.8	11	7.8	8.7	19	8	8.4	16	8.6	8.5	14	9.8	8.8	15	10.5	9.1
Mike James	0	12	9.8	9.8	11	10.6	10.2	10.5	9.6	10	15.25	11	10.3	13.5	9.8	10.2	16	10.5	10.2
Patrick Chavez	0	9	9.8	9.8	12	9.5	9.6	11	11.9	10.5	13.5	10.5	10.5	13	10.6	10.5	16	10.5	10.5
Paul Barnett	0	15	9.8	9.8	26	12.9	11.5	21.5	11.2	11.4	6	7.2	10.3	20	7.5	9.6	13.5	9.3	9.6
Paul Augustine	0.5	8.5	9.8	9.8	14	10.1	10	11.5	9.6	9.8	12	11	10.1	19	11.5	10.6	15	9.9	10.4
Simon Rubinstein Salzedo	0	15.5	10.8	10.8	11	9.5	10.1	18	10.4	10.2	19	8.6	9.8	26	10.2	9.9	16	9.3	9.8
Total	3	105.5	90	90	135.5	90	90	141.8	90	90	136.75	90	90	165.75	90	90	137.75	90	90

Figure 6: Formative and summative assessment of contributions.

As a result of using TeCTra in semesters Spring 2004, Autumn 2005 and Spring 2005, the distribution of peer-marks show only about 20% of groups distributing marks close (0-5%) to an even distribution. Note the thick line that shows the period total and represents the overall trend in the period.

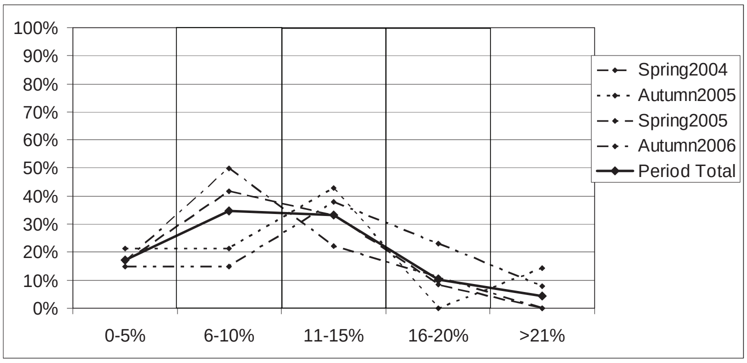


Figure 7: Period supported by TeCTra

The introduction of TeCTra produced a dramatic change in the students' peer-assessment of individual contributions. Only 20% of groups allocated marks with little or no diversification and 65-75% of groups diversified marks by 6-15%. This is a more accurate reflection of the expected range of students' individual contributions within a large groupwork project. As the students were not obliged to use the TeCTra calculated individual Weighted Contribution Factors in allocating their marks, it seems that progressiveness and visibility of peer evaluation, feedback and review empowered individuals to claim their ‘rightful’ share of the marks. Non-performers were exposed early through the formative assessment of their peers, and they had two options, either to improve or to accept lower summative marks.

Conclusion

Figure 8 combines the graphs of the distribution of peer marks for the three peer assessment approaches discussed in the paper. The results demonstrate that without TeCTra’s online support the students were not capable of reflecting individual contributions in the marks allocated to team-members and an equal distribution of marks was given to 75-90% of their peers. The visibility of individual work on the project provided by the online time-records improved the situation by reducing the percentage of groups with a near-equal mark allocation to about 55%. This result proved that reliable evidence of individual efforts empowered team members to claim better marks and the groups were willing to accept resulting mark differentiation. The most significant change in peer-assessment mark distribution occurred with the introduction of the current TeCTra system that has facilitated peer evaluation, feedback and review assessment processes. An equal distribution of peer-marks is now only about 20% and the distribution has become significantly wider and a better reflection of the variety of individual contributions to large groupwork project outcomes.

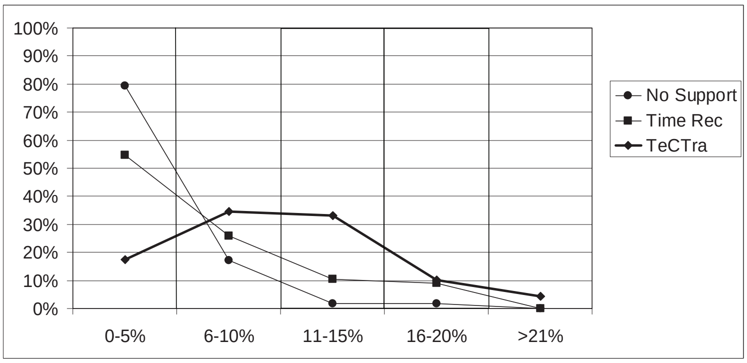


Figure 8: Overview of the changes in the distribution of peer-marks due to changes in peer-assessment strategies from 1998 to 2005.

TeCTra provides visibility of individual efforts and outcomes. Apart from time records collected in the earlier system, TeCTra also records deliverables produced. While rating their team members, the students were presented with all individual results produced in the week being assessed. It ensured that the rating process was evidence-based.

TeCTra supports peer evaluation, feedback and review – both a quantitative rating and qualitative comment – throughout the duration of the project and thus formatively and positively influences individual contributions and behaviours within the team. This improved capacity for peer-review facilitates diagnostic attributes and thus significantly influences the overall project management process and outcomes.

TeCTra supports the development in students of the ability to evaluate, give feedback, review and assess the work of others, to make professional judgments, to articulate well-justified decisions and to communicate in a non-confrontational manner to their peers – core skills and graduate attributes for most novice professionals. Knowledgeable yet inexperienced individuals are supported to act professionally and take responsibility for and accept the consequences of their own contributions to large groupwork projects.

TeCTra is relatively simple for the students and the staff to operate and avoids complexities and additional work that present in other online tools (Clark, 2000). The online tool’s user-friendliness is important as increasing academic teacher workloads leave minimal time for the administration of elaborate self-and-peer assessment methods and tools (Fisher, 1999).

There is still a question about whether TeCTra produces marks that do reflect the true individual contribution of each team-member. The students are not under obligation to use TeCTra contribution factors for their peer-mark allocation and indeed the majority of groups choose not to use the TeCTra contribution factors. Yet there has been no return to the previous practice of allocating marks close to an equal distribution. It has to be concluded that the online tool did make the difference. It seems to have changed the group dynamics although the mechanisms behind that are not quite clear and will be investigated through student usability evaluations in future research.

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Fun and feedback at the press of a button

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A common phenomenon across disciplines and universities is that students complain that they do not receive enough feedback, even when student evaluation forms indicate satisfaction in other areas such as teacher competency and enthusiasm. On the other side, but less considered, is the lack of feedback that teachers receive as they struggle to get students to participate and engage with the learning process. While technology does not offer an automatic solution, keypad-based automatic response systems do offer the potential to let both parties know how well the learning outcomes are being achieved in a timely and cost-effective manner. We have just completed two years of pilot trialling of such technology at our university in the Computing and Physics Departments. This paper reports our experiences together with the findings of others.

Keywords: feedback, collaborative learning, socratic learning, keypad-based technology, personal response system, computerised audience response systems (CARS)

Introduction

Student motivation, engagement and timely feedback are critical factors affecting learning. It is becoming increasingly important for teachers to make learning enjoyable and to some extent entertaining. Currently individual teachers face the challenge of how to present material in more interesting and innovative ways and to encourage greater problem solving and engagement with the material by students. Additionally, students and teachers need to know whether the learning objectives are being achieved before the final exam. The use of keypad-based technology, known by a number of names including Personal Response System or Computerised Audience Response Systems (CARS), offers the opportunity to concurrently address the engagement, enjoyment and feedback issues. By providing questions for consideration by the class to your Powerpoint slides, students are encouraged to actively participate in lectures and tutorials in a fun way that also gives them instant feedback via a wireless handheld keypad while remaining anonymous. Thus, the technology supports a Socratic method of learning with a twist: instead of students learning by asking questions, they learn by being asked questions.

Many lecturers currently use questions in such forms as problem statements, case studies, examples and quizzes to get students to interact and participate. In our experience, students are often reluctant to venture an answer even for structured problems requiring students to simply vote whether they do or do not agree. The reasons why students do not participate may include embarrassment, uncertainty of the answer or what is required and not wanting to look un-cool by doing as the teacher requests. These impediments to getting students to fully participate can potentially be reduced via the use of the keypad-based technology.

Not only does immediate feedback to the class enable the lecturer to correct widespread deficiencies in understanding but individual class members get feedback on how they are doing compared to the rest of the class without being singled out. The shy student can have as much say as the more assertive students. When used for group activities the technology can enhance team identity and membership.
The keypads can also be used for capturing actual responses for feedback and assessment purposes by identifying to whom a device has been allocated. This is helpful for inclass tests that may be conducted weekly in lectures and/or tutorials as part of the assessment structure or for infrequent assessments such midterm tests. Mid-term tests have been found to be a good strategy for encouraging students to stay on top of the material and serves as a wake up call to both the students and the teaching team about the current level of ability of the students. However, manual marking and reporting of these inclass tests can

be onerous due to the time requirements and may not be possible due to budgetary constraints. With the decrease in IT students together with ongoing pressure to improve our quality of teaching, a solution, such as that offered by the Keypad technology, which automates assessment and provides feedback may have an important role to play.

While some benefits of the keypad technology have been considered we acknowledge that technology does not offer an automatic solution to the various problems experienced in education. From an economic point of view it is often difficult to find any evidence of the benefits of technology (Landauer, 1995). However, when there is “a good fit between a particular learning situation and specific technical solution” striking positive results can be found (Draper, Cargill & Cutts, 2002). CARS have been employed for teaching in many fields including: physics; business; statistics; mathematics; information systems; pharmacy; psychology; medicine; and electrical engineering, and in many universities nationally and internationally including: Melbourne University; Monash University; University of South Australia; Glasgow University; Brisbane Graduate School of Business; Indiana University; Columbia University Medical Centre; and University of Massachusetts. In this paper we report our usage of the technology in the Computing and Physics Departments which was funded via a teaching grant as a pilot for the rest of our university.

In the next section we provide an introduction to the technology and some of the uses reported at other institutions. Following that, we describe the ways in which we incorporated the technology into a few of our second and third year courses and the results of having done so. Then we describe the methodology we used to develop the content and integrate it with our existing courses. Finally, we conclude with some discussion and future directions.

The technology

Keypad technology allows individuals to use a small numeric keypad to communicate with a computer system via infrared or wireless. The responses from individual keypads can be received and collated for each session and used to provide instant grading, polling or just feedback to the participants. Despite the responses being in one direction (from keypad to receiver), the technology facilitates a two–way communication channel between the teacher (who posed the question on the slide) and the student (who responds to the question).

An early Electronic Classroom Communication System (ECCS) known as ClassTalk used scientific calculators hardwired to a network (Abrahamson, 1999). Another example is EduCue which offers a personal response system known as InterWrite[i]. We have been using the Turning Point[ii] software and KEEpad[iii] devices. TurningPoint can be used with a variety of response devices including infrared and radio frequency keypads as well as networked PDAs, laptops and desktops. Figure 1 shows what a typical handheld device from KEEpad looks like. Products such as TurningPoint offer sophisticated presentations, question-style formats, analysis and reporting features.

Figure 1: A typical KEEpad

Setup is simple and requires a three step process of:

1 Install TurningPoint software which adds a specialized toolbar to MS Powerpoint;

2 Set up devices by connecting the receiver to the computer and following in the installation screens; and optionally
3 Setting up the participant list. Step 3 is only required when the teacher is interested in keeping track of the responses of individual students for marking purposes or understanding the responses by demographic charactistics.

SOURCE: http://www.keepad.com/pricing.php

Prior work

The usage of audience response technology is not new or uncommon. We present here a sample of the findings and helpful hints of others who have used the technology. For example, after years of experience within its various courses, the Columbia University Medical Center for Education Research and Evaluation concludes that audience response systems technology has the potential to: "Promote active learning and discussion; clarify and expose misconceptions; support interactive case study analysis; enhance retention of information; assess students' mastery of content; adjust lecture emphasis according to needs; elicit diverse points of view when there is no correct answer; and give immediate feedback to students" [iv]. The site also stresses that "clear educational objectives" are needed to drive the design of slides. A useful tipsheet containing best practice and common pitfalls is provided at: http://library.cpmc.columbia.edu/cere/web/facultyDev/ARS_handout_2004_tipsheet.pdf. Another leader in the application of technology in teaching, including the use of keypad-based technology, is the Physics Department at Indiana University, as evidenced in the 70 page summary by Hake (1999).

Dufresne et al. (2000), also from a US physics department, points out how students and teachers need to learn to modify their behaviour and particularly their "habits of mind" to fit the new technology. They offer a model-based design paradigm that is founded on cognitive research results and the premises that: proficient problem solving requires structured knowledge; structuring knowledge requires certain cognitive processes and it is possible to create activities and experiences to stimulate beneficial cognitive processes.

Draper has developed a website[v] that offers assistance with issues related to forming questions such as: "decomposing a topic the audience was lost with", "selecting the next question" "designing a bank of diagnostic questions" which can be used to assist in the design and evaluation phases described later. Sokoloff and Thornton (1997) have novelly used the technology to capture the predictions of students during physics experiments to improve engagement and understanding. Their studies have found that persistent learning is achieved by this means as the concepts were later assessed in final exams with a 7% improvement in results.

It is interesting to note, that just as medicine led the way in introducing problem based learning into its degrees, it seems again that the traditional sciences such as medicine, physics and biology have been early adopters of ECCS's such as the keypad.

Within the field of mathematics, Butler and Butler (2006) provide an up-to-date summary of the uses of personal response systems, including recommendations for planned improvements and future research. Closer to home, from a teaching domain and geographic perspective, Banks (2003) has extensively used keypad-based technology to support group decision-making processes in the information systems (IS) area. Sharing of views, greater understanding and a more reflective approach to learning were achieved in four separate uses of the technology: peer review of student presentations; quality assurance subject evaluation; peer review of collaborative group-work; and sharing interpretations. Banks (2003) has found keypad systems to be useful for enabling: communication; learning desire and commitment; customised instruction and data collection with both undergraduate and postgraduate populations. Also in the IS domain, Tsvetinov, Abercrombie and Do (2005) used KEEpads with first year students to get them talking together without the "bounded rationality" which typically occurs with group thinking. Additional related work is described in the next section intermingled with the description of our usage of keypad-based technology.

Case studies using KEEpad

Our first usage of KEEpad began in Semester 1 2005. Three units were third year units that involved a year-long group-based project that also required acquisition of some new subject material related to software engineering such as project management, modelling, quality and change control. In 2006, two second year subjects were chosen for trailing the software: a second year programming unit and a second year astronomy unit. We are currently preparing materials for use in a first year programming unit (we do not present any discussion of this unit). The types of presentations we created using TurningPoint, and employed as indicated in the following case studies, followed one of three styles:

- Template 1: Standard question/result mode (multiple choice questions, create histogram) for use in lectures/tutorials to assess understanding;
- Template 2: Class discussion mode that poses a question, lets groups form and be identified in the presentation. Groups then get together to discuss the option chosen to defend to the rest of the class;
- Template 3: Peer assessment.

COMP229: Object oriented programming practice

Student Population: Around 200 2nd Year, sometimes 3rd year, Computing students.

Unit Description: This unit bridges the gap between introductory programming and larger multi-person projects by considering the use of object-oriented techniques to produce intermediate-sized software.

Practical exercises emphasise the importance of programming practices such as appropriate documentation, systematic approaches to debugging and testing, and the use of software development tools. This unit is a first introduction to JAVA and builds on 1st year C++ units.

Keypad Technology Learning Outcomes (template 1 only): Test out current knowledge. Motivate discussion by identifying weak areas of student knowledge. Provide two-way feedback and encourage participation. Exam preparation.

This unit is a traditional Computing unit that does not involve project or group work, except for one of three assignments. Use of the keypads in this unit was along the lines used in similar types of units at other institutions. At Monash a CARS was used in a second year electrical engineering course (Su, 2003) to encourage students to pre-read lecture materials, to run short tests to determine student understanding of a particular section, for assessment in tutorial and mid-semester tests, to develop multichoice questions by student groups to pose to the rest of the class.

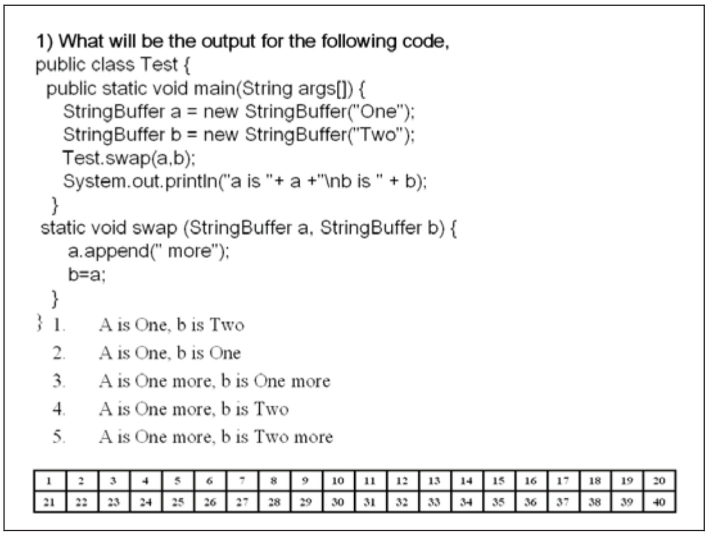

Figure 2: Screen shot of a question used in COMP229

Keypads were first used at the end of Week 4 to assess the students' grasp of the fundamental concepts. Some questions related to snippets of code and whether they would compile, run or what output or error message would be produced. See an example in Figure 2. Other questions related to more theoretical concepts such as the differences between various collection or exception classes or layout managers, how Java works, the use of JUnit, the order of constructors, and so on. We found in this domain that many multiple choice questions could be found on the internet, thus saving the time to design a question. Also, multiple choice is commonly used in certification exams and thus testing using this paradigm was also valuable practice for those wishing to go for certification.

Due to lecturer changes, the keypads were not used again until week 13 when students used the technology as practice for the exam. To fit with the use of the keypads in 2005 and 2006, the exam was also changed so that one quarter of the exam used multiple choice questions that could also be automatically marked (but not via the keypad system).

In the first year we conducted a survey, via the technology, to determine how well the technology was received by the students. Based on the responses of 40 students (we only had 40 keypads – distributed on a first come basis, others participated indirectly) on a five point likert scale students responded that:

- They found the keypads easy to use (4.2);
- They enjoyed using the keypads (4.1);
- The keypads helped me participate (4.31);
- The keypads helped me learn/revise (4.0);
- They would like to use the keypads again (4.3).

Comments were solicited from all students. Only the following were received:

- "excellent and fun";
- "it's really fun";
- "wowwwww… it was amazing…. and funny …. and encourage me and challenge me to study more and more. Good on you for doing something unusual but useful";
- "Overall very good";
- "we need more of it. Keypad ams the pwnzor!!Ione";
- "next time have enough for the whole class";
- "it was fun and educational";
- "perhaps run the questions faster so more questions can be fit into a 1 hour lecture".

In all sessions using the keypads in this unit, there seemed to be a feeling of excitement or a buzz in the air. It could be that the technology is still very novel and that over time, the effort involved in distributing and collecting the devices would counteract the positive mood currently experienced. When a question had many wrong answers, some time was spent on explaining why one or more of the options were right or wrong. At times it was quite a surprise to both the students and the lecturer when a question was poorly answered. Tailoring of the set of questions was done on the fly according to the amount of discussion, time and apparent interest or weaknesses of the students. For example, questions covering similar material could be skipped if the concept seemed to be understood.

We would have preferred to be able to incorporate questions into any lecture throughout the semester and at any point within the lecture that required some discussion, change of pace or test of understanding. However, it was quite a logistical hurdle to carry a notebook, a pouch of 40 keypads, the sensor and stand across campus. To provide an orderly means of distribution and honesty system, we asked students to place their student card in the pouch of the keypad they had taken from the pouch at the start of lectures, and return the keypad at the end of the lecture. If we had 200 keypads, this process may have been worse, though we would have distributed pouches of keypads in various locations so it may not have been significantly more difficult. We discuss some alternatives to the current technical/logistical limitations of the technology in the final section of this paper.

COMP340: Systems engineering project

Student Population: Up to 40 3rd year Bachelor of Computer Science students with GPA ≥ 2.75.

Unit Description: This unit introduces students to the concept of the project process and the many activities which must come together in a successful systems development project. This is achieved through a lecture stream and being a member of a team of 4-5 students working on a year long industry-based project.

Keypad Technology Learning Outcomes (template 3 only): Peer assessment of student presentations. (These presentations replaced lectures. Students were given a topic by the unit convenor which they researched and then gave a 20 minute presentation to the convenor and their peers based on the text book and other relevant material). Encourage better presentation and audience attendance and participation. Improve (perceived) equity of assessment.

The keypads made it feasible to acquire the approx. 480 responses (40 students * 4 assessment criteria (content, presentation, materials, discussion) * 3 presenters) each presentation session. At the press of a button the lecturer could determine the average mark for each criteria, the overall mark and standard deviation, allowing comments and the overall marks to be emailed to the presenter on the afternoon following the presentation. The rationale for changing to peer assessment included:

- Peer assessment has been found to be a valuable learning mode;
- The mark is derived from multiple assessors rather than based on one person's opinion. This takes the pressure off the lecturer to appear equitable;
- Students in the audience are more encouraged to attend and listen as they get to give their input;
- The student presenter is encouraged to make the presentation more engaging.

Additionally, the keypads were made available to the students to encourage audience participation in their presentation and some students took advantage of this option with good results.

In a study conducted by Banks (2003) involving keypad-based peer review, the following ten presentation marking criteria were used: introduction and summary; up-to-date; accuracy; comprehensive; structure; clarity; timing; pace; audiovisual aids; and interest. While there is potentially merit in doing so, we note that after only two weeks of collecting separate responses for all of our four criteria, students collectively requested that they be allowed just to enter one overall mark per student – rather than distinguish between content, presentation, materials and engagement.

The most interesting outcome of the use of keypads for peer assessment of the student presentations in this unit was that almost without fail, the average score given by the students was within half a mark of the overall score that the lecturer awarded. This is surprising because even though students gave one mark out of 10, the average across the group matched closely with the lecturer's score which was broken down into the four components and weighted (content (3), presentation (2), materials (1) and engagement (2)). Note, however, that sometimes the standard deviations were very large. Such a result would take the burden off the marker and department budgets and provide a further motivator to use peer assessment in addition to the rationale offered above.

COMP345/346: Computer science project / information systems project

Student Population: About 20 3rd year Bachelor of Information Science/ Technology Students.

Unit Description: This unit provides an introduction to software engineering, describing the software life-cycle and the techniques that can be applied in each of its stages. Approximately half of the material is concerned with methods for analysis, specification and design, including the functional and object-oriented approaches. The remainder addresses issues of management and quality assurance. These units involve a substantial group project drawn from the full breadth of IT applications (for COMP345) or involving modern database technology in an information systems setting (COMP346).

Keypad Technology Learning Outcomes (templates 2 or 3): Peer assessment of student project deliverables. Comparison, evaluation and feedback of ideas and artefacts produced. Encourage better presentation and audience attendance and participation. Improve (perceived) equity of assessment. Unlike in COMP340, the object of peer review was the project deliverables. We also intended to incorporate the keypads into tutorials as lecture sizes were expected to be around 100, and we only had 40 keypads to trial the technology. At third year level we do not see value in multiple choice or true/false questions that are simply at the right/wrong or mark focused level. Instead our goal was to pose questions that don't have a fixed answer or which are unanswerable on their own because more information is needed, more along the lines of template 2. See the sample questions proposed by Steve Draper[vi] relating to the learning of statistical concepts. The goal of posing such questions is to challenge thinking on the topic, to present alternative views, to explore why something would be right or wrong, determine what data/knowledge is missing, etc. The sequence would be: pose a question, get individuals to respond, display results, invite individuals to speak to why they chose that response, if needed, lecturer discusses the merits/shortcomings of each answer. A followup question can then be asked to test whether the key "right" concept/s were acquired by the majority. This approach uses the "Peer Instruction: Mazur Sequence.[vii]

Another alternative is the Class Wide Discussion: Dufresne (PERG) Sequence where a question is posed and small discussion groups are formed. The groups or individuals then vote on the question. Given that discussion has taken place, it is more likely that students will have a clearer idea in their mind why they chose that option, or each group can be asked to defend their answer. The lecturer can clarify concepts as they are discussed and correct where appropriate. We found that this technique did assist with discussion, but the technology to some extent was a gimmick and not worth the effort of setting up. Also, given that the students were working in teams and also as a unit whole focused on solving the same industry-based problem but offering alternate solutions, the need for anonymity was not so important.

The major use of the keypad in this unit was for peer assessment of other group's solutions. Demonstrating a system to a lecturer is different to presentation before your peers. In such sessions, the lecturer sat back and let groups ask the demonstrating group for justification of why a certain design choice had been made or explanation of how something worked. This was a very valuable exercise. While the same exercise could have been conducted without the keypads, the fact that you were being anonymously graded by your peers encouraged greater engagement and commitment to the process. Banks (2003) reports the use of keypad-based technology to capture and process more fine grained and meaningful data about individual team members and its presentation to the group. In the approach, the staff member leads a discussion about ways to remedy problems that have been identified. Banks notes that, while finding out what others think of you can be humbling and even hurtful, students have found that they are better able to modify their behaviours according to the groups' needs. Anonymity of individual scores can be maintained to encourage honesty and freedom of opinion. However, in 2005 and 2006 we did not receive the number of enrolments we had anticipated and thus only had less than 10 teams in each year to manage and have thus not incorporated the ideas of Banks at this stage.

PHYS270 – Astronomy

Student Population: >20 students, primarily 2nd year students from a variety of backgrounds including science, physics and education, also 1st year students from the astronomy stream.

Unit Description: This unit is a foundation course in astronomy suitable for aspiring physicists/astronomers and non-scientists alike. No prior knowledge of astronomy or physics is required as PHYS270 gives a broad underpinning of basic astronomical subjects and concepts with the essential mathematical content. A diverse range of astronomical topics are covered, starting with the solar system and then moving on to galactic stars, nebulae, galaxies, quasars, black holes and basic cosmology. The unit has a large experimental component including a night session at the division's observatory.

Keypad Technology Learning Outcomes (template 1 only): Test current knowledge at start of course, providing two-way feedback. Revision sessions at the end of semester as exam preparation.

In PHYS270 the keypads were used early in semester one, 2006 to assess the students' prior knowledge of basic astronomical concepts. The questions used were taken from a number of multiple-choice "pre-test" question sets found on the internet, and addressed various topics such as the phases of the moon, concepts of gravity, astronomical distances and simple cosmology. These were used to identify areas where the students' general knowledge was particularly weak, so that these topics could be properly emphasised in the lectures. The students were also asked a number of demographic questions in order to discover their level of mathematical competence, their confidence in their ability to study maths and science and their expectations of the course.

At the end of this session, the students were asked their opinions on having used the keypads, using a five point likert scale. Their responses indicated that:

- They enjoyed using the keypads (3.6);
- They believed the keypads could be useful as lecture tools (4).

A number of students gave negative responses to the first question, as they were concerned that use of the keypads would take time away from lecture material.

Due to time constraints, our plans to include keypad use during lectures never materialised, although material is currently being prepared for semester one 2007.

In the last week of the semester, the final three classes were dedicated revision sessions, using the keypads (in anonymous class feedback mode) to ask the students multiple-choice questions on the material previously covered in class. A typical revision session asked 20 questions in an hour, giving the lecturer time to discuss and correct any lingering misconceptions and explain to the students why they may have chosen the wrong answer. The questions were taken from the accompanying material to the textbook, and were chosen to closely correlate with the coursework and with past exam papers.
At the end of the revision work we asked the students a series of questions about using the keypads in future classes using a five point likert scale. They responded that:

- They enjoyed using the keypads (4.35);
- They would find it useful if the keypads were used for revision of key points at the start of lectures (4.37);
- They would find it useful if the keypads were used to introduce topics during lectures (4.4);
- They would find it useful to do assessed multiple choice questions throughout the semester (in moderation) (3.25).

Comments were sought from the students and the general consensus was that the keypads were "cool", but that they should have been used more during the semester.

Incorporating automated response systems into teaching

In order to employ the keypad technology, we followed the following iterative process:

- **Analysis/consultation** with the academics involved in teaching the unit. Discussions concerned presentation of what the technology looks like and how it works; possible uses and previous uses in the literature; what content, if any, was appropriate; what type of assessments were being performed and how the keypad could assist; class sizes and how to handle if there were more than 40 students since we only had 40 keypads; where, when and what type of feedback was most important for that unit. Depending on the interest and commitment of the lecturer and the perceived value of the technology, key units were identified for inclusion of keypad-based technology.
- **Design** the modules/quizzes for the selected units. For example, how will quizzes be run, how will feedback be provided, what will the role of assessment be? Use of the technology for assessment should be more limited at first as this may require redesign of the unit and will be of greatest concern to the students. Our focus for pilot usages was on demonstrating to students and lecturers how the technology can be used and, in the case of the latter, training them to apply it for themselves. Given that some slides do not contain course content, such as peer assessment slides that capture a score, such slides could be stored in a shared repository for use by any lecturer interested in such a resource. However, setting up slides is so simple, we doubt that the effort involved in maintaining a bank of

such generic slides would be of value. There is, however, value in using questions from prerequisite units that could be stored in a shared question bank at the start of the follow-on unit to assess student competence and whether catch-up lectures are needed.

- **Development, deployment and maintenance** of the presentations according to the outputs of the analysis, design and/or evaluation phases. This phase requires following the user guide to perform such tasks as: selecting the appropriate slide format, filling in the fields, selecting what results are required and how the results will be displayed, preparing report formats, adding a timer if required, configuring the devices. This phase also included using the Powerpoint presentations and collecting relevant data about student responses. We include maintenance in this phase as presentations will need changes when improvements are identified or errors detected.
- **Evaluation** of the technology usage against a set of predetermined criteria. The most obvious criteria are the learning goals. In this technology, evaluation can be instantly provided. For example, as soon as students enter their responses via the keypad the teacher can display the results. Reports can be easily produced with questions linked to learning outcomes that indicate when most of the class have achieved competency. Other criteria which require more detailed and longer-term evaluation include: return on investment; increased attendance/participation; improved marks in assessments and pass rates.

While it is desirable to see improved learning and higher results achieved by students in the units using this technology, it would be very hard in the short term to make any valid claims linking improved performance with the technology. However we believe that strategies such as mid term tests are very valuable forms of timely feedback to teachers and students and that this technology should be able to allow us to conduct such tests which have tended to become too labour intensive to administer. We could expect to see over time, with the (re)introduction of tests, assessable and non-assessable, and increased student engagement and motivation, that overall results would improve.

At this stage what we have reported are results from a couple of lightweight surveys regarding satisfaction and various anecdotal evidence. We have not conducted trials aimed at providing evidence of return on investment in terms of increased student satisfaction/improved learning outcomes, more timely feedback and reduced marking costs. On the latter point it is easy to calculate the number of marking hours saved where existing assessments are being replaced since that data is already collected. However, the problem is that we have mostly introduced additional tests that are not currently funded, e.g. peer assessment marking and adhoc tests. Also, we have used the technology to support fulltime academics who do not directly pass on costs of individual tasks they perform in teaching a unit. Further, in evaluating teaching methods it is not possible to treat students differently and have a control group which is not taught using the new method, unless the differences are reversed or resolved by completion of the unit. While some claims could be made based on improved scores of a cohort, it is difficult to be definitive about the causes of such improvements. Dissemination of our findings, as provided in this paper, is also part of the evaluation we have performed.

Discussion and future directions

Lecturers typically try to encourage interaction with students in lectures/tutorials but without real feedback in both directions it is difficult to determine if the ideas are coming across. Studies using keypad-based technology are often motivated by the need to assess each individual’s understanding or viewpoint and the realisation that quite often there are only a few in the group that really understand what is being said. The others have become disengaged. The main problem identified in large classes in large lecture theatres is usually the lack of interaction which results in extreme passivity rather than active learning (Draper, Cargill & Cutts, 2002). In support of these findings, at a recent Computing 300-level liaison meeting, students informed us that the number of friends you have has a big impact on your likelihood of success in assignments and tutorials (this goes beyond plagiarism issues which we are actively seeking to control and minimise). Relying on friends becomes a mind set where a few bright students identify the key parts of the solution and others simply need to work at the more concrete level implementing their ideas. To counteract plagiarism, the Computing Department relies heavily on final exams for assessment but this results largely in testing how well the text book can be memorised and does not test who is competent in applying the concepts. From an industry point of view, this is unacceptable and delivers students that will not be valuable employees. Using the keypads requires students to pay attention in lectures and think about the content for themselves. In this respect, this technology has the potential to significantly change the character and capabilities of the students we graduate.

A technique that the author has been using for a number of years in lectures is to get students to solve a problem on paper and to hand in the solution for review. In a subsequent lecture or tutorial, students are shown many of the models developed, including good and bad examples. This approach has been particularly used for concepts that large numbers of students continue to get wrong. It seems that seeing your own examples and various other counterexamples does a great deal to break long term conceptual errors that have occurred through shallow and rote learning which are encouraged by summative assessment approaches, for example end of semester final exams. Formative assessment, in contrast, is “low stakes and low stress…the focus is not on the ‘right’ answer, but on the distribution of answers and the reasoning behind each one” (Dufresne et al., 2000). Ongoing use of the keypads allows us to assess throughout the course how the students’ understanding is developing and where the weak spots are. We found that getting the “right” answer was often not the point, but that opening up discussion of how different problems, concepts and ideas could be interpreted got people talking and thinking.

We would like to explore further the idea of Su (2003) of getting students to develop multiple choice questions for other individuals/groups as it means that students must first identify key learning concepts themselves, identify the nuances between various solutions, the approach is collaborative and the burden of preparing questions is passed on to the students making the technology more tenable for adoption. We suggest that the overhead involved in preparing problems in problem-based learning is probably the key reason why problem-based learning is not used more widely. However, we are unsure whether first or second year students have the maturity to develop quality questions. At third year level and above we are unsure whether multiple choice or true-false questions are so relevant. Despite our reservations, in the future we would like to explore this possibility, perhaps in tutorials.

The key limitation we found with using the keypads concerned the logistics of carrying, setting up, distributing and collecting the physical equipment. We envisage that if the university perceives value in using the technology the TurningPoint software will be purchased and installed on all lectern computers, a receiver will be installed in all lecture theatres and that each student would purchase or be given a keypad at enrolment at a cost of around $5 per student. This keypad could be registered to the student and used in whatever class the student attended. However, the set up and support of this infrastructure would be a considerable cost to the university. With a view to the future, Russell and Pitt (2004) suggest the following possibly more practical wireless solutions:

- Personal digital assistants (PDAs) with basic infrared (IR) connectivity;
- Cell phones using wireless application protocol (WAP);
- Cell phones capable of downloading Java applications;
- Pocket PCs like the Hewlett Packard iPaq;
- Cell phones that also include wireless local area networks (WLAN).

We expect that in the not so distant future that these solutions will have software and hardware to support them. At that stage, the technology should be accessible to any teacher or student who wants to have some fun while they get essential feedback.

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[i] http://www.educue.com/interwriteprs.htm
[ii] TurningPoint is a product of Turning Technologies, LLC. Portions Responsive Innovations, LLC and Microsoft Corporation.
[iii] We have been using devices produced by KEEpad http://www.keepad.com
[iv] http://library.cpmc.columbia.edu/cere/web/facultyDev/ars.cfm?cat=facultyDev&pgNav=ars
[v] http://www.psy.gla.ac.uk/~steve/ilig
[vi] http:www.psy.gla.ac.uk/~steve/ilig/feedback.html
[vii] http://www.psy.gla.au.uk/~steve/ilig/qpurpose.html

The evolution of audiographics: A case study of audiographics teaching in a business faculty

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Audiographics was an established educational technology prior to the development and spread of the World Wide Web (Web) in the early 1990s. First generation audiographics products used bridged telephone lines (audio) and modem linked computers (graphics) to synchronously connect an instructor with groups of students. In the second half of the 1990s the use of the Web increased dramatically and traditional audiographics use declined. Since the early 2000s, and as part of the development of a second generation of Web services, Web 2.0, a new generation of audiographics tools, now commonly termed collaborative or Web conferencing software, have become available. This evolution of the audiographics technology and its associated instructional capabilities is explored via a longitudinal case study of the use of audiographics in the Faculty of Business at Southern Cross University. Following a review of the first and second generation products used, we identify and show how four key lessons from the initial period of use have been addressed. We focus particularly on how the fourth lesson (flexibility of the delivery format) has been addressed and present preliminary data gathered from early student and staff adopters about their use of second generation audiographics during Semester 2 of 2005 and Semester 1 of 2006. We conclude by briefly discussing some potential developments and suggesting that second generation audiographics offers the opportunity to seriously re-think the nature of student-to-student and student-to-staff communications in the context of our learning and teaching environment.

Keywords: audiographics, tele-teaching, Electronic Classroom, Elluminate Live!, teaching business online, web conferencing, virtual classrooms, synchronous tools

First generation audiographics

Audiographics established itself as an educational technology before the invention of the World Wide Web. The typical layout involved linking a number of classrooms or training sites via a combination of voice circuitry; the ‘audio’ component being a loudspeaker telephone, and linked computers providing ‘graphics’ component. At its most basic, two rooms were linked by low end computers and modems over one telephone line, while a voice link was established over a second line. The instructor controlled the session from a computer in one room and the other became a ‘remote classroom’ where students gathered. Additional classrooms (usually not more than 3 or 4) required telephone bridging (often purchased from the phone company) and additional computer/modem connections. Depending upon the number of participants at each site, speaker phones and multiple screens (or a single projector and large screen) may have been used.

Instructionally, first generation audiographics provided a relatively low cost, low technology solution that was applicable to many teaching and instructional settings. It provided an interactive voice environment supported by a shared whiteboard and the ability to distribute documents and graphics – the fundamental features of the traditional face-to-face lecture room or tutorial. It required minimal user training and was able to draw on existing electronic educational resources or other resources that could be easily scanned and saved in electronic format.

Electronic Classroom®

A local product, Electronic Classroom®, developed by a Queenslander, Robert Crago, captured the Australian market. The software was written in C+ for the Macintosh platform. Over 1000 copies were used in Australia during the 1990s and of these about 7% were in use in universities (Ellis, Debreceny and Crago, 1996).

Within 5 years of its introduction Electronic Classroom ® could be found in use across a range of educational settings: K-12 (Gray & O'Grady, 1993; Oliver and Reeves, 1994), higher education (Ellis & Debreceny, 1994), teacher in-service training (Knapczyk, 1992; McCullagh & Stacy, 1993) and staff training (Miller, 1991). Ellis, Debreceny and Crago (1996) summarise the technical evolution of the product.

To the instructor or student the product displayed a very simple interface – a whiteboard with menu bar, that displayed standard File, Edit, Text, and Paint menus and single left-hand side vertical tool bar that allowed for screen control, provided simple tools (for text and drawing) as well as set of indicator lights, one for each remote site, that allowed control to be requested and passed from site to site. Where more than two sites were involved the audio networking was done using a telephone bridge. This service was often booked using the local telephone company services. The screen features and typical teaching resources will be demonstrated as part of the conference presentation.

Second generation audiographics

In the second half of the 1990s the first generation audiographics technologies became one of the casualties of the rapid growth of the Internet and the equally rapid technical evolution of the Web. This demise was due to a number of factors including:

1. The spread of Internet accounts from research and university environments into schools, colleges and the commercial and domestic marketplace. This provided a cheap and convenient way to interconnect computers locally, nationally and internationally. Educators now had a rich source of material including text, images and video. They could locate instructional and resource materials on almost any topic and at almost any level.
2. Improvements in compression technologies that allowed the delivery of VoIP (Voice over Internet Protocol) of a quality similar to traditional phone line audio connections.
3. The availability of faster modems (up to 56K) as well as ADSL modems (256/1500K) and even faster cable modems, that provided the capacity to exchange large files and allowed for application sharing. Higher bandwidth also allowed for the "remote control" of one computer by another at speeds sufficient to undertake (demonstrate) complex tasks.
4. Improvements in compression technologies and the miniaturization and cost reduction in colour video cameras (webcams). These developments made basic, small window videoconferencing over IP easy and affordable.
5. Larger, higher quality colour screens allowed multiple control panel features and shared work spaces to be designed for display using a single Web browser screen.
6. The ubiquitous presence of Web browsers and widespread user familiarity with point and click browser-based software have removed the need for extensive pre-session training. Users can literally learn as they use the system and training is now more focused on just-in-time training and performance support.
7. The spread of lower cost and progressively more powerful consumer level computers together with cheap headset speaker/microphones and Webcams, gives individuals the opportunity to join sessions from their workplace, home or even from a hotel while travelling.
8. The falling cost of hard disk storage space makes it possible to archive large amounts of data on fast recall systems so that users have easy and fast access to recorded sessions.

These factors combined to allow the development and marketing of a second generation of audiographics software, now commonly described as "Web conferencing", "virtual meetings" or "collaborative" software. Some of the most widely used systems now on the market include:

- **Centra® 7** http://www.saba.com/products/centra/index.htm – a line of integrated products that are targeted at schools, universities and business meeting and training environments.
- **Webex** http://www.webex.com.au/au/webexhome.html – state they provide browser-based, on demand Web conferences, Web meetings, Webinars and Webcasts.
- **Breeze 5** http://www.macromedia.com/software/breeze/ – is marketed as a rich Web communication system that can be used for online training, marketing, sales and Web conferencing.
- **Live Classroom** http://www.horizonwimba.com/products/liveclassroom/ – is one of a number of integrated tools provided by Horizon-Wimba and claims to provide a fully featured live virtual classroom.
- **Elluminate Live!** http://www.elluminate.com/ – offers tools such as VoIP, shared whiteboard and applications, remove control, text chat and video for e-learning and collaboration. It is aimed at both the education and business market. SCU, Deakin, Curtain, Chisholm and TAFE WA are current licence holders.
- **Citrix MeetingToGo** http://www.citrixonline.com/ – claims to offer an easy, secure and cost effective solution to conducting meetings online.
- **Microsoft Live Meeting** http://www/mocrosoft.com/office/uc/livemeeting/default.mspx – this product has been evolving and is now a far more complex product than its competitors. Its greatest attraction is probably the integration with the Microsoft Office suite.

Elluminate Live! has become the second generation product of choice for the staff of the Faculty of Business at Southern Cross University (Rowe & Ellis, 2006).

Elluminate Live!

Elluminate Live! is a Canadian product and has evolved from an earlier product called vClass. It was specifically designed to offer an online, real-time training, demonstration and collaboration environment for remote teaching, training and meetings (Farmer & Nobes, 2004). A range of other uses have emerged, including online conferences and seminars (Carrington, 2005; Laurillard, 2006; Rowe, 2006; University of Hawaii, 2006) and those uses continue to expand.

With the release of version 7 (July, 2006) the effectiveness of the product was increased by participants being able to talk over the Internet with full duplex audio, text chat, share video, whiteboards, multimedia files and share applications – all in one intuitive, Web browser interface. The program can be hosted on a server at Elluminate's Head Office (Calgary, Canada) or can be installed on a user's own server. The proprietary Collaborative Communications Framework (automatically ensures that everything is in the right place at the right time) was built specifically for live, multi-media collaboration. The product is Web browser based, so from the users perspective is operating system independent. There is very minimal lag time or garbled communication when using voice, either on a dial-up modem or a high-speed LAN. When there is a connection problem, you are automatically reconnected to the room at the point of interruption with all content still there. These are powerful features enabling users to maintain a clear focus on content rather than the technology (Elluminate Live!® Version 7.0 Moderator Quick Reference Guide).

Following an initial system check and once-only download of the program to the user's computer, it is simply a matter of using a Web link (URL) to join each session. This link can be set up and made available in a variety of ways. Using the link initiates a check to see that the current version being used is available on the user's machine and opens a 'room' for use. The features available in the room are established by the moderator for the session.

The basic features of the program will be shown during the conference presentation, but are summarised here for those not able to attend. The standard interface comprises a set of drop-down menus across the top of the screen. There are four basic panes to the screen, three on the left hand third of the screen and the fourth on the remaining two-thirds. The top left hand pane is for participant management and lists the names of those present in the session, privileges available to them (for example, access to the microphone, whiteboard tools and application sharing features) and a series of interaction icons (polling options, raise/lower hand, emoticons and temporary unavailability). The moderator (leader) of the session can vary these privileges individually or for the group as a whole. This is the part of the screen used to allocate and observe participants working in small group activities using the break-out room feature.

The middle left hand pane is a direct messaging (text-chat) area. This ensures that even participants without a microphone have the opportunity to ask and/or respond to questions. The messages can be broadcast to: all participants, just to the moderator, or between individual participants. The text can also be resized (and coloured) to cater for those with vision impairments. The bottom of the left hand pane is the audio panel. This allows access to the microphone and controls for volume of speaking and hearing.

The large right hand pane is the whiteboard area. It can be used with text and graphics tools and also serves as the projection screen for viewing presentation slides, application and multi-media sharing. If the privilege is granted, participants are able to annotate material and use shared applications on the whiteboard.

Instructional use of Electronic Classroom®

The use of Electronic Classroom® at Southern Cross University occurred for a number of years in the early 1990s because of the enthusiasm and work of a couple of staff members who were early adopters of the technology. One staff member was able to demonstrate the technology within the School of Social and Workplace Development while the other was able to both demonstrate and teach using the technology within the School of Commerce and Management, Faculty of Business.

The ‘champion’ staff member in the Faculty of Business taught a number of his accounting subjects to small groups on the Lismore and Coffs Harbour campuses and the then regional study centres in Tweed Heads and Grafton. The teaching of units involving accounting principles, often requiring the use of spreadsheet type graphics, which was ideally suited to ‘virtual classroom’ environment provided by Electronic Classroom®.

Why was this initial use successful? The staff member was a Mac user and enthusiastic about using technology in his teaching. It also saved him the time required to travel between campuses and regional centres by car.

Why did the use not spread with the School and Faculty? In Commerce and Management while staff members had a high level of computer literacy they used the Windows platform and, while the Electronic Classrooms® Mac interface was not complex, it was nevertheless not what they were used to. In the School of Social and Workplace Development while many staff members were Mac users their overall level of computer literacy was not high and many stated they preferred face-to-face contact with students.

Use of Electronic Classroom® ceased three years after it commenced when the accounting staff member championing its use moved to an overseas university. At the same time the Web became a cheaper and lower cost way of sharing resources and specifically teaching resources such as self study packages.

What lessons can be learned from this initial period of use? The most important lesson was to recognise that innovation is often driven by an individual, a local champion, and can falter if that individual ceases to be active. Secondly, it is important to recognise that the development of new and “competing” technologies, even when they don’t compete directly, can reduce the appeal of an existing technology. Thirdly, it is important to note that there was no provision to record and play back sessions. Late students missed the work and students could not use the actual (recorded) class session for revision. Finally, it needs to be recognised that there was very little flexibility in the physical delivery format. Both the staff member and students had to be attending specially set-up teaching rooms at allocated times. Phone line bridging and software limitations did not allow individual students to link in directly from their homes.

Instructional use of Elluminate Live!

This section will show how each of the lessons identified above from the initial phase of using audiographics in the early 1990s have been addressed in the second period. This will be followed by a summary of feedback from students and an outline of the variety of instructional (and other) uses that have already been used in these early stages of the second period of using audiographics. This will focus on how the final of the lessons identified above – the lack of flexibility in the physical delivery format – has been addressed.

The first lesson was to recognise that innovation is often driven by an individual, a local champion, and it may falter if that individual ceases to be active. This remains the case. One of the authors is the current driver for phase two. While efforts are underway to ensure that some support structures are put in place so that the current phase is less dependent on the individual, much additional effort and goodwill in a challenging institutional budgeting environment is required. Rowe (2004) provides a reflection on the impetus for adopting online delivery methods, while Rowe & Ellis (2006) outline the "accidental" way the current local champion came to be in this position.

The second lesson above recognised that the development of new and "competing" technologies, even when they don't compete directly, can reduce the appeal of an existing technology. One of the key attractions of Elluminate is that it is works on Macs and PCs. The distinct advantage here is that participants are able to use the program on the computer they are most familiar with, using material they are most familiar with, rather than learning a new technology in a "lab" situation perhaps on computers they are not used to and using constructed material that may have little meaning to them.

Another aspect worthy of mention regarding the lesson is that users are far more comfortable with technology (Vitartas, 2006) now then they were in the early 1990s simply because they use it so regularly in their activities. The fact that many applications are now browser-based also means that the earlier technical connection challenges are just not an issue any more. Another example is the way that the current local champion has piggy-backed on the use of tools available within the learning management system to get to the current level of involvement with second generation audiographics (Rowe, 2003 & 2004). One of the key elements of this was the encouragement to use the virtual classroom (text based) tools that emerged from focus group activity with colleagues who were early adopters of other features within the learning management system (O'Reilly, 2003).

While Elluminate can be used as a building block within our learning management system, the decision was taken not to attempt this during our initial phases. One of the real benefits of this is that staff have been able to develop their familiarity and confidence with audiographics quite independently of the learning management system. This has been important because it has enabled certain delivery approaches to mirror what staff have done previously by alternative means. A simple example has been the change to audiographics for teletutorial sessions previously delivered using a third party arranged telephone conference. Feedback from both staff and students about the improvement in what is achieved in the sessions has been overwhelmingly positive and is dealt with in more detail later.

The third lesson, like the second, is no longer an issue due to the advances in technology. Second generation audiographics have a recording function so that play back is available immediately the session is completed. The recording can be paused, stopped, fast-forwarded. The slides and text messaging can also be saved from the recording and several interactive tools can be used during playback. An example is taking a quiz that may have been delivered during the live session. Students who were unable to attend the session (for whatever reason) can access the material at a time convenient to them – an often quoted advantage of asynchronous tools that fits well with this synchronous delivery tool. This feature is also invaluable for the moderator as a professional development opportunity. This aspect is explored further next, and also in the *Future directions* section below in relation to the potential for staff training, professional development and quality review processes, both locally and internationally.

The final lesson from the 1990s was the recognition that there was very little flexibility in the physical delivery format. The features and tools available in Elluminate presented above, are testimony to how this is no longer the case. Preliminary data about student and staff use is now presented to support this. The validity of the effectiveness of these features and tools has been captured in feedback obtained from students in surveys collected during teaching periods where it has been used. This feedback is summarised next. It is presented according to use over the first two semesters of implementation – the initial 6 month 25 seat licence for semester 2, 2006 within the School of Commerce and Management and the first part of the extended 12 month 50 seat license for semester 1, 2006 within the Faculty of Business. This is supplemented by a summary of the number of staff adopting Elluminate and the variety of ways they are using it .

Semester 2, 2005 use survey

Rowe (2006) reported the results of student feedback from semester 2 of 2005. Although the sample was very limited (9 of 10 active students from an online Advanced Auditing course) the feedback from the first cohort of the SCU students to use the program provided invaluable input to the decision to extend the use to the Faculty level for all of 2006. The survey was conducted independently by a representative of the Teaching and Learning Centre using a semi-structured phone interview averaging 45 minutes. The results are summarised here as a point of reference for the wider range of responses gathered during semester 1 of 2006 reported below.

The overall results highlighted overwhelming satisfaction. This is supported by level of attendance at the voluntary weekly sessions. Of the 12 sessions conducted during the course, the average attendance was 8 out of the 10 active students, with 8 or more attending 7 of the 12 sessions. The ease of use and lack of technical issues were consistently mentioned in responses. The most valuable (and easy to use) tools reported were the microphone (audio), the emoticons, hand-up icon and the whiteboard. While it is acknowledged that these were also the most frequently used tools as the moderator was learning the tools, it also highlights the most commonly used features of a physical classroom (bearing in mind the whiteboard also acts as the projection screen). All students indicated a preference for live voice over text chat, enjoyed the interaction with fellow students and 6 indicated a preference for Elluminate over face-to-face classes.

Semester 1, 2006 use survey

While this initial feedback provided impetus, the pre and post questionnaires used to collect student feedback for semester 1 of 2006 for Faculty of Business adoption, were adapted from Schullo (2005). There were 40 respondents to the pre-use survey and 25 respondents to the post-use survey. Demographic information is provided in Table 1. The discussion below focuses on the student perceptions of their computer literacy, expectations and experiences.

Table 1: Demographic details for interviewees/respondents

	Semester 2, 2005	Semester 1, 2006	
		Pre	Post
Number of respondents	9	40	25
Gender	4 M, 5 F		
Age (mature >25)		23 Mat, 17	15 Mat, 10
Location	7 Ext, 2 Int		
Study mode	7 P/t, 2 F/t	28 P/t, 12 F/t	15 P/t, 10 F/t
Stage of course (year 1,2,3)		1(5), 2(11), 3(24)	1(6), 2(6), 3(13)
Course	BBus (9)	BBus (39), BBA (1)	BBus (17), BBA/BIS (8)
Computer	8 PC,1 Mac	39 PC, 1 Mac	
Connection	7 BBand, 2 Dup	17 BBand, 19 Dup, 4 dnk	

Pre-use survey

In computer proficiency, most respondents (72% of the total of 40) ranked themselves as an intermediate or advanced user. When particular application types are grouped together, an interesting sub-set emerged. This intermediate or advanced proficiency rating rose to 94% for the grouping of word processing, spreadsheet, presentation and email – the most commonly used applications. The rating dropped dramatically (to 55%) for the less common application grouping of chat, webpage creation, audio & video programming and web browsers.

In regards to previous online learning experience, 22 (55%) respondents said that they had never done any online course before, 7 (17.5%) had done one online course and no one had experienced two online courses. However, 3 (7.5%) had done three online courses and 8 (20%) had done at least four online courses. They were then asked if these experiences had involved any synchronous online learning systems (SOLS). Only 9 (22.5%) reported some experience with SOLS with the others (77.5%) reporting little or no experience at all with SOLS. 8 respondents (20%) had used text-chat features of a SOLS, 1 had made use of two-way audio and 3 (7.5%) had experienced application sharing. No one indicated having used two-way video or a full synchronous online classroom.

Given this very low number of students who had experienced online learning using a SOLS, the responses to questions about the initial setting up process to use Elluminate are interesting. It is noteworthy that they support the feedback from semester 2, 2005. 20 (50%) respondents found it easy to set up while 12 (30%) thought it somewhat hard to deal with. Only 8 (20%) indicated that it was actually difficult to set up. These proportions correspond closely to the respondents who found the instructions clear or somewhat clear (75%) compared to those who felt they were unclear (20%). Common problems reported include failure in downloading, failure in installation, students not having Internet connection or student's ISP blocking the program.

As noted earlier, the ability to record and playback sessions is one of the key lessons that has been overcome from the experience of the early 1990s. Respondents were asked about their intention to use the playback feature of sessions. 27 (67.5%) respondents indicated they intended to use the recordings, with the remaining 13 (32.5%) indicating they were not sure. The breakdown of this between part and full time respondents indicates that playback feature could be more useful for part-time students. 11 (91.7%) of the part-time respondents intended using the recordings, while only one part-time respondent was not sure. In contrast, a much lower proportion of full-time respondents 16 (57%) intended to playback sessions with the remaining 12 (43%) being unsure.

Post-use survey

In this section, the focus changes from respondents expectations to their experiences. Questions focussed on attendance patterns, the features used, and respondent's level of, and reasons for satisfaction with Elluminate.

While 23 (92% of the total of 25) respondents reported participating in 3 or more sessions, 20 (80%) of those reported taking 4 or more. The other 2 (8%) reported participating in 1 or 2 sessions. 18 (72%) respondents preferred to participate in sessions from their home, an indication of the need to consider convenience and changing location when planning delivery approaches. 3 (12%) respondents did not attend any live session because they played back recorded sessions, adding further weight to the potential for exploring alternative delivery options.

Respondents reported using many available features. The most common comprised two-way audio (18), text-chat or direct messaging (18), whiteboard (18), application sharing (11) and hand raising (9). Data gathered about the perceived usefulness of various tools tended to correspond to the tools most frequently used, that is, the more a tool was used, the more useful it was reported as being. While the audio tool was not separately asked about in this regard, text-chat (80%), whiteboard (68%) and hand-raising (68%) were most highly rated as useful. This is consistent with the findings of semester 2, 2005.

While 16 (64%) respondents reported problems connecting to a classroom at least once and 14 (56%) reported problems in using two-way audio at least once, the rating of tools by respondents highlights that these issues are more of an annoyance to users than a major issue. For example, only 5 (20%) respondents ranked whiteboard (presentation space) 'N/A' or 'Poor' while 20 (80%) thought it fair, good or even very good. The audio tool had only 3 (12%) respondents unsure (N/A or Poor) about its quality and 22 (88%) rating the quality fair or above. The rating for screen layout was almost identical. 22 (88%) respondents reported they often or always felt more connected to fellow students and 21 (84%) to their lecturer. 20 (80%) respondents thought their lecturer's approach was often or always effective. 18 (72%) respondents were often or always satisfied with the peer interaction. One strong point made by respondents was to acknowledge the enthusiastic support from their lecturers as a firm motivation for their participation in sessions – this needs to be interpreted in the context that ALL sessions are promoted as supplementary and *not* compulsory.

A further reflection of the overall satisfaction with the communication aspects is that 24 (96%) respondents reported being happy to take another course next semester if it involved using Elluminate. When asked about whether they believed taking a course using Elluminate was a good decision, 23 (92%)

respondents said ‘yes’. One said ‘no’ and one was unsure – and the student who said “no” had completed his final course and indicated that he would definitely consider using it again if he had more courses to complete. Students who have experienced our more traditional tele(phone) tutorials were unanimous in reporting Elluminate as a more efficient and effective solution for distance education.

Staff adoption and types of use

In this section a summary of the number of early staff adopters and what they are using it for is presented. During semester 2, 2005 only two staff within the School of Commerce and Management actively used the program for teaching (auditing and quantitative methods). It was actively used for demonstration purposes “to spread the word” within the School, Faculty and wider SCU community (for example as a method of presenting a seminar for the Teaching and Learning Centre). The decision for an expanded Faculty license was taken in December 2005.

During semester 1, 2006 16 staff actively used the program in teaching 14 units, for student orientation sessions and postgraduate supervision activities. The teaching activity included 5 accounting staff teaching a component of our commitment into Hong Kong Institute of Technology. In addition, it was used for meetings with offshore partners, international academic colleagues for collaboration, seminars and conferences. The use for demonstrations to non-Business Faculty users continued and liaison with IT staff was extended. Face-to-face classes were both recorded and broadcast live to remote participants, including (live) delivery from Hong Kong, United Kingdom and France. Active alternative delivery for tele(phone)tutorials and (face-to-face) workshops was initiated.

As semester 2, 2006 begins, the program is being actively used for teaching in 26 units by 18 staff (5 of whom did not use it in Semester 1). Use for a wider range of meetings has been scheduled for both academic and administrative functions. The delivery into Hong Kong will be repeated. A Vice-Chancellor’s Strategic Initiative award will be used to improve and modify the way training is presented and sessions are arranged, including streamlining the operation of the established user group sessions. An on-going program for gathering student feedback and the initiation of staff feedback is also set in place to inform some of the potential discussed in the next section.

Future developments

There are a number of trends that will see audiographics not only continue but almost certainly expand to become an important distance education tool. In terms of hardware, the integration of home television systems with personal computers will see the ability to output data to various types (plasma, LCD etc) of large, high definition screens. This will eliminate the problems of providing instruction via a small, poor quality screen and will give students using these systems literally ‘table top’ size work areas. It is also likely that touch screens will become increasing important (we are already seeing a resurgence with the rise of the tablet PC). Falling storage costs means sessions can be easily stored either by an institution, local service provider, even by a dedicated large capacity hard disk owned by the researcher.

Software enhancements will no doubt soon include the ability to extract audio or video steams from recorded sessions and repackage them for playback as podcast or videocasts thus adding an extra degree of mobility to the learning environment. The closed captioning feature offers potential for delivery in offshore locations to experiment with delivery into a local language.

In terms of social and cultural issues, such as the rise of terrorism and regional wars and the possibility of epidemics and pandemics, along with the increased cost of travel (mainly fuel), it is likely that quality distance teaching using the latest interactive technologies, will become increasing sought after as a means of safe, efficient study.

In terms of instructional design it is likely that audiographics will become a common peer-to-peer communications technology that students will become familiar with even before they enter university. ‘Lite’ versions of programs carrying a small amount of advertising are an established model for moving expensive proprietary technologies into the wider public domain.

The potential to use the playback feature as a professional development opportunity is also worthy of further exploration. The potential for tailored staff training, professional development and quality review processes, both locally and internationally exists. Staff training can be tailored to specific tools most useful for the range of common uses. For example, the way polling tools and application sharing are used in meetings requires different skills to their use in a class setting. The ability to train and offer opportunity to offshore partner staff to deliver class sessions locally can be offered. Reviewing sessions allows staff to review content and delivery aspects of their skill set.

Conclusions

The current generation of Web browser based audiographics products, typified by Elluminate Live!, provide an easy to use, engaging environment for both instructors and learners. The ability of both students and instructors (with a laptop) to join a session from literally anywhere in the world with an Internet connection, eliminates the "be at a specific place" demand of traditional education and to some extent the record and playback features reduces the other traditional demand of "be there at a specific time". Student to student communication is also supported and the ability to use "break-out rooms" for small group collaborative work and remote (external) student presentations is easily arranged.

Given that future developments in related technologies are likely to further enhance the audiographics environment, while at the same time cultural factors, resource pressures and safety issues are likely to make traditional environments less attractive, then perhaps distance education will soon redefine itself, not as the poor cousin of traditional face-to-face classes, but as the preferred mode of study where learning is in your own time and place with all the resources you need at your fingertips.

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E-Scholars: Staff development through designing for learning

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Although the importance of engaging students in learning through interactivity during the learning process is well documented, faculty and instructional developers often fail to consider learning design during the curriculum design process. In face-to-face and online courses, curriculum is often developed by staff in isolation, with a focus on *presenting* content rather than on learning design that promotes student *engagement* with content as well as interaction with peers and instructor. This paper describes the design, implementation, evaluation and next steps of the 'e-Scholars Programme', an innovative approach to staff development designed to guide faculty as a cohort to successfully integrate online learning with the face-to-face classroom using the T5 instructional design model (Salter, Richards, & Carey, 2003, 2004) to expand the learning environment.

Keywords: staff development, blended learning, feedback, instructional strategies, course design, learning communities

Introduction

Although the importance of engaging students in learning through interactivity during the learning process is well documented, faculty and instructional developers often fail to consider learning design during the curriculum design process. Too often, whether for use in face-to-face classrooms or in online environment, curriculum is developed with a focus on content coverage and/or *presenting* content rather than a focus on designing a learning environment that promotes active *engagement* with the content. Studies consistently report that between 73-83% of teachers choose the lecture format as their main instructional method. As described by Blackburn, "Give faculty almost any kind of class in any subject large or small, upper or lower division and they will lecture" (Blackburn, Pellino, Boberg, & O'Connell, 1980). In the typical lecture class model, class time is generally instructor directed for 90-100% of the time. However, a great deal of research shows that the lecture is little more than an information transaction and is not an effective way to create deep learning or creative thinking (Weigel, 2002).

Increasing demand to incorporate technology into teaching has placed additional challenges on faculty and institutional systems as they attempt to 'put courses online'. Often technology is simply used to replicate existing practice in an online setting. The approach of many teachers in the face-to-face class is to cover a pre-determined amount of information in a lecture/information-transmission format. It is unlikely that the shift to an online environment will do more than offer the content (in the form of power points or course notes) in an online course management system unless planned intervention is provided to guide staff in innovative, interactive approaches to course design.

University teaching and learning centres have attempted to provide support for faculty as they incorporate technology into teaching. Common models of staff development include individually guided instruction, (such as one-on-one consultations) and also group workshops or seminars that follow a 'training' model of instruction. When group instruction is provided, workshops often separate training in the 'use of the technology tools' from the pedagogical guidance that is needed by many university teachers. When this separation occurs, faculty may learn 'how to' but not 'why or when to' as the theory of best practice is separated from the actual applied work. Instructors attend sessions that are mainly presentations in a lecture format given by staff developers on the 'how to' techniques. Following the seminars, instructors are expected to work on their course redesign and implement new ideas in isolation. Although a well presented lecture can be an effective way to deliver essential information or ideas quickly and efficiently, research suggests, that as an instructional method, this approach does not result in 'deep learning' of the content presented (Biggs, 1978; Entwistle & Ramsden, 1983; Marton & Saljo, 1976). However, deep learning is required to attain higher quality learning outcomes (Trigwell & Prosser, 1991) such as the synthesis of new ideas and the transfer of learning to new applications.

It is unlikely that teachers will synthesise the new ideas and undergo a paradigm change in their approach to course design and instructional strategies without opportunities for staff development that fosters interactivity and social learning through dialogue and discussion. Based on feedback from faculty internationally, during workshops I have given on the T5 model in Sri Lanka, Australia, Thailand, Hong Kong, the USA and Canada, the following key challenges have been consistently identified by staff as they attempt to integrate a blended approach that incorporates the use of online activities:

- Instruction in the use of technology is often provided for staff by the institution's technology support centre rather than integrated with instruction in best teaching practice provided by the educational development centres;
- University teachers are often uncomfortable using technology and are not aware of the types of online tasks and interactivity possible in a blended learning environment. Most begin by adding content in the form of power points or course notes without interactivity;
- When staff learn about the 'types of technology tools' available, the tendency is to 'add on' rather than incorporate activities as part of the course design process. In addition, when they attempt to incorporate online activities for students they are not provided with practice and feedback from instructional designers as they develop ideas for their courses;
- Lack of instructional design support to work in progress results in a tendency for staff to use tools simply because they are available, without considering desired learning outcomes or learning impact;
- Staff generally do not 'rethink' how the use of class time is possible when online components are incorporated;
- Following staff development programs, staff are expected to work in isolation to change their course design and teaching practice with limited opportunity for feedback to work in progress.

A more effective method of staff development may be provided by a process based approach to incorporate professional development around projects (such as curriculum revision, or technology innovations) that are designed to solve a problem. Learning occurs through the participants' involvement in a staff development program related to their specific project or course. This model may prove to be more effective as a method to help faculty incorporate high quality technology innovation into their teaching in a pedagogically sound way. An example of a process model of staff development is provided in the Courseware Design and Development Program (CDDP) at the University of Melbourne (Hirst Brooks, & Riddle, 2004). Academics participated as a cohort in a program that integrated a major curriculum development project along with professional development as staff developed multimedia and educational technologies to use in their courses. The authors report that the CDDP was a sustainable model and that the 'left in the cupboard' syndrome was not evident in the deliverables associated with this project.

The current paper describes the design, implementation and evaluation of another example of a process based approach to professional development, the 'e-Scholars Programme'. This programme was designed to guide faculty as a cohort to redesign courses and successfully integrate online learning with the face-to-face classroom experience to expand the learning environment. The e-Scholars Programme was designed to engage staff in subject level e-learning development by participation in a learning community that would promote:

- a planned course of professional development for staff to 'rethink' their courses as they redesign to incorporate a blended learning approach;
- direct funding (if needed) for development and implementation of the individual subject-level development work;
- instructional design support during course design and development;
- systematic evaluation of learning impact.

Theoretical framework of the e-Scholars Programme

The e-Scholars Programme was implemented in June, 2006 as a professional development program for staff at Hong Kong Polytechnic University. A call for proposals invited staff to apply to participate in the program to re-design their courses for blended learning. The design of the programme builds on the foundational work done at the University of Waterloo during 2001-2005 (Salter et al., 2003, 2004). The building blocks for the programme to guide staff in their course re-design combine two key components, (a) the 'T5 model' and (b) applied 'learning mapping'. In the T5 model, the learning environment and supporting resources are designed to include five key elements: (i) Tasks (learning tasks with deliverables and feedback); (ii) Tools (for students to produce the deliverables associated with the tasks); (iii) Tutorials (online support/feedback for the tasks, integrated with the tasks); (iv) Topics (content resources to support the activities); and (v) Teamwork (role definitions and online supports for collaborative work). Learning tasks require students to engage with the course content to produce a completed task as a 'deliverable'. The deliverables, and feedback to these deliverables, are the primary vehicles for learning (Salter et al., 2003, 2004). The T5 approach provides a simple model to support faculty in a paradigm shift that encourages the design of an interactive, task-based 'learning environment' rather than a focus on 'information transmission' through content delivery (Salter et al., 2004).

The 'learning mapping' process extends the usefulness of the T5 approach by guiding staff to consider the most appropriate places to integrate learning tasks and feedback in a course. The process guides instructors to consider the cognitive complexity of the learning outcomes and instructional challenges. Bloom's taxonomy (Bloom, Mesia & Krathwohl, 1956) is used in the learning mapping process to help instructors write learning outcomes and design appropriate learning tasks to help students achieve the learning outcomes.

The goal in using the 'mapping' approach is to help instructors avoid the tendency to use too many tasks without considering a pedagogical reason for choosing when to incorporate a task. Exemplars are provided during the process to help instructors to consider the different types of tasks to incorporate, depending upon the desired learning outcome. During the 'learning-mapping' process, instructors develop a 'paper-prototype' of their new course design by mapping out course learning modules/units of learning to include specific learning outcomes, assessment strategies, instructional challenges and appropriate junctures in the course to include learning tasks, and feedback. In summary, a combination of the T5 model with applied learning mapping:

- Represents a task-based approach to learning;
- Incorporates a strong emphasis on feedback to all tasks (formative feedback);
- Maintains the textbook as an important resource in support of learning tasks;
- Discourages presentation of content either in face to face lectures with the overuse of power points or by putting content online;
- Identifies different ways to use time and space (class time vs. study time);
- Provides a framework for instructors to map out their course;
- Does not require instructors to become experts in instructional design;
- Provide recommendations, exemplars and templates for learning tasks;
- Allows flexibility for the instructor.

Implementation of the e-Scholars Programme

There are 4 phases to the implementation of the e-Scholars project at Hong Kong Polytechnic University:

1 Professional Development (June 12-16, 2006);
2 Subject development (July/August 2006);
3 Implementation (Sept.-April 2007);
4 Evaluation, Dissemination, Revisions (Jan-June 2007).

During the e-Scholars professional development workshop, through a combination of homework and coaching sessions, staff apply the T5 model to define the course learning outcomes, consider the challenges for students in achieving these outcomes and subsequently design appropriate 'learning-tasks' to help students meet the learning outcome. A clear distinction is made between a task designed to engage the student with learning the material and an assessment exercise designed to measure a student's mastery of the material.

Five sessions were held with daily sessions over a one week period (Table 1). The T5 model was used in the design of the workshop series so that the participants engaged with the content material prior to the face-to-face classroom time. Each session was designed as a ‘coaching session’. Participants were provided with content resources ahead of the face-to-face sessions and had learning tasks to complete prior to each session. During the coaching sessions participants applied the concepts and engaged in dialogue to share ideas. Staff ‘learn by doing’ in the series as they created learning tasks with defined deliverables and feedback for their own courses to help students meet specific learning outcomes. An important part of the coaching session is the dialogue between participants; this allows them to clarify misconceptions about using online technologies, describe preliminary ideas for tasks, receive feedback to help in developing these ideas and discuss best practices. In coaching sessions, the coach/facilitator ensures that new ideas are fully understood so that they can be incorporated into practice.

The approach used in the staff development series for the e-Scholars program is modelled after The New Classroom Series, first offered in November 2001 by Salter and Richards at the University of Waterloo. More than 200 faculty, staff and librarians at the University of Waterloo participated in the series between 2001-2005. After completing the series, 78% of the participants reported using the model to some extent to add task-based online components to a course. By invitation, the New Classroom Series has been adapted and delivered internationally to faculty and instructional designers in Hong Kong, Sri Lanka, Thailand and Australia as well as at the University of Waterloo and in four Ontario colleges. The pedagogical approach of this series for staff development appears to have strong appeal to higher education audiences.

Table 1: Overview of e-Scholars Programme professional development modules

Session A (3 hours) - A Model for Blended Learning - Learning-Centred Teaching / Best Practices ‘online and off’ - Creating interactions for Active Learning - Changing the Time and Space of Learning (changing the use of online/out of class time and face-to-face classroom time - Using technology to help with common instructional challenges - Designing Learning Tasks to Enhance student learning - Introduction to ‘Course-Mapping’
Session B (3 hours) - The importance of feedback in learning and teaching - Using technology to enhance feedback to students and make feedback manageable for instructors - Introduction to Course Mapping - Coding course content for course mapping - Using Bloom’s taxonomy to define learning outcomes - Identifying level of difficulty of subject content - Applying course mapping templates
Session C (2 hours) - Course Mapping Applied – Part 1 - Applying course mapping process to your subject - Identifying specific treatments for each module of your course
Session D (2 hours) - Course Mapping Applied – Part 2 - Continuing to apply course mapping process to your subject - Feedback on work done so far - Continue working through each unit of study in the course to identifying specific treatments for each module of your course
Session E (3 hours) - Individual presentations of subject revisions and sharing of ideas - Coaching and feedback on course mapping process - Planning next steps for continuing work on the course mapping process and preparation for individual consultation and summer work

Following the face-to-face coaching sessions, participants entered the subject development phase (July/August 2006) to prepare their course for fall or winter term delivery. During this phase instructional design support, technical support and if needed funding support is made available. Technical and pedagogical support is provided through the e-Learning Development and Support Section (eLDSS). In addition to individual consultations for instructional design support, opportunities were provided for the participants to meet over the term as a 'community of practice' (Lave & Wenger, 1991; Wenger, 1999) to share ideas during their continued work on course development. In these sessions instructors were given the opportunity to pilot the ideas for their course during the development process and receive formative feedback and subsequently revise as needed.

During the e-Scholars professional development workshop, sessions were designed as coaching opportunities for participants to 'learn by doing' and receive feedback to their course ideas in progress; this was the beginning of set of relationships that could develop into a longer term community of practice. A community of practice involves a set of relationships over time, organized around a particular knowledge area or activity that gives members a sense of joint enterprise and identity (Lave & Wenger, 1991; Wenger, 1999). To sustain the community of practice for the e-scholars, continued opportunities for sharing ideas and practices were provided by setting up additional opportunities for participants to meet as a group and by initiating an e-scholars blog to see if an online venue to discussed ideas would be utilized (Sims & Salter, 2006).

In addition to professional development and technology support, participants were eligible for funding support to assist with the completion of the project deliverables of web-based, re-usable course materials. These materials and activities will be put into a course management system (CMS), either web CT or Moodle (depending upon the instructor's choice of CMS) for delivery to the students in subsequent terms. Rather than provide the funding 'up front' and have participants work independently on projects, the funding is allocated as staged funding to be provided as participants complete the different stages of their project and is provided on an as needed basis. Participants could request the first funding allocation upon completion of the staff development week long series after completion of their paper-prototyped course learning map including draft task ideas. Funding enabled staff to hire a student or research assistant to work on the online components of the course during the development phase. The e-Scholars project was allocated a total project funding of $1 125 000.00 HK as part of the allocation of funding for e-learning development innovation projects based on the projection that up to 15 applicants would be accepted into the project; each would be eligible to receive up to $75 000.00 HK.

Evaluation plan

The evaluation component of the e-Scholars program involves two aspects: (i) evaluation at the larger scale 'project' level (the process-based staff development program that guided faculty in their course redesign) as well as (ii) evaluation at the 'course' level (the participants' individual deliverables in the form of redesigned courses). At the project level the key question to be addressed is: "Was the e-Scholars program able to promote active learning-centred teaching?" At the course level the key questions are "Does the course redesign method employed (use of the T5 model and course mapping to incorporate tasks, feedback and active learning) lead to changes in the use of class room time to allow more discussion, feedback and interactivity? Does the course redesign method employed lead to improvements in students' achievement of course learning outcomes?"

Project level evaluation: Outcomes of the e-Scholars Programme

Fourteen staff, representing six departments participated in the first e-Scholars Programme. All fourteen completed the professional development workshop phase and are currently developing courses in a blended mode. Eight plan to teach their course during the fall term (September 2006) and six during the winter term (January 2007). Two participants are working on two courses and one pair of teachers is co-developing a course, giving a total of 17 courses that are expected to be offered to students in a revised mode during the fall and winter term.

Preliminary evaluation of the post-session feedback from the professional development workshop shows that all participants in the e-Scholars workshop rated that they would highly recommend the series to other staff who plan to re-design courses (mean score 5/5 on 5 point scale) and rated the format of both in class coaching and out of class homework to engage with the content resources as very beneficial (mean score 4.6/5 on 5 point scale). Participants also indicated that the course had helped them 'rethink' their approach to incorporating a blended component as shown by the following sample of unedited comments (July 2006):

> The course helped me change my course to a more interactive manner re using class time differently and using online interactions.
>
> The templates for learning tasks really help with the application of the ideas to practice.
>
> The course is the whole ‘box’ – online and face-to face. I found the online triggered deeper levels of engagement than I had anticipated. Forced to commit to ideas – was excellent.
>
> Really enjoyed the sessions. Wonderful experience. I really enjoyed the sharing between participants that the coaching sessions allowed.

Course level evaluation: A systematic evaluation of learning impact

Evaluation of the outcomes of the programme deliverables, in terms of the analysis of the re-designed courses, and the impact on student learning is in the early stages as the courses are still in the implementation or development phases. A systematic evaluation will be carried out on each course during and post implementation. This evaluation will include data collection using the following methodologies/instruments to observe associated indicators:

Table 2: Course evaluation plan

Methodology	Indicators
Student feedback - questionnaires, focus groups	perceived usefulness of the learning tasks, perceived increased opportunities for interactions (with peers/instructor/course material) relative to other courses
Instructor feedback - questionnaires, focus groups	perception of the success of course redesign in overcoming the stated instructional challenges, perceived usefulness, perceived interactions (with peers/instructor/course material) relative to other courses, perceptions re students preparedness for class
Classroom observations	observations of classroom actual interactions, changed usage of class time, preparedness of students, student responses to questions
Student performance	preparation for class, student usage of online components, performance on tests/assignments to show achievement of learning outcomes related to the content of the course that was taught in a new way
Attributes of the redesigned course	Review of the final course deliverable to assess: • opportunities for students interactivity with content, instructor, peers (tasks/blogs/forums other tools and how they were used to engage students in learning); • quality of students comments; • type of feedback to student learning; • type and number of learning tasks for students to practice course material.

The preliminary analysis of work completed by the instructors during the development phase is encouraging in terms of seeing learning-centred changes in course design and delivery ideas. The changes incorporated promote time on task and engagement with learning. Since educational researchers acknowledge that these are key factors to academic success and deep learning (Trigwell & Prosser, 1991; Vella, 2000; Weigel, 2002) the course revisions made have the potential to impact on student learning.

The following shows one example of how an instructor plans to change a course in a in Hong Kong Taxation Law.

To deal with instructional challenges identified by the instructor, online tasks were created for four of the course modules to incorporate pre-class tasks and post-class tasks. The changes made fulfil the requirements to provide interactivity, feedback and practice in the redesigned course as follows:

1. Interactivity: Students are required to complete the pre-class task ahead of class and submit online (interaction with content is required to complete tasks). Students are expected to make an attempt and will receive a 'good faith effort' mark if pre-and post class tasks are completed. The students will now be prepared before class and have some prior exposure to the concepts to be discussed in class. The tutors will use class time to discuss the tasks and relevant concepts, respond to student's questions about the concepts that they have submitted to the discussion forum, and move on to the next required step for the course learning module (interactivity during class time with peers/tutor/content).
2. Feedback: Instructor feedback to the students' posted responses will be provided during the tutorial. Before the tutorial the instructor will review the online responses and use the class time to address specific questions. Students will also have an opportunity to review other responses online and compare the responses of other students with their own comments.
3. Practice: Pre-class tasks will introduce students to the concepts, in class discussion will allow them to discuss ideas and strategies and post class tasks will be provided to re-enforce the concepts through application of the principles.

In a traditional lecture-based teaching paradigm, only the instructor is engaged in preparing for a class; students do little preparation and come to class to be 'fed the content' in a lecture format. This instructor rethought the approach to instruction in this course by engaging students in pre-class tasks and changing the use of class time. Table 3 shows the task plan created by the instructor to map out the tasks for Hong Kong Taxation.

Another example of the use of a discussion forum to change the use of class time is provided in a generic anatomy course revision. The following written instructions were given by the instructor to the students regarding the required completion of pre-class tasks:

> The purpose of asking you to do this is to make the lecture time more meaningful to you. The work you will do before coming to class <u>will NOT be completely repeated in class</u>. Therefore it is essential that you devote some time to these tasks and come prepared to the lecture. (… more details provided for the students here about the tasks and how they were to be completed through online submission…). Your responses to all of these questions will help us know how to best present the material in the lecture.

Out of the 480 students in this class, 400 students responded by posting questions and comments into the online discussion spaces provided. The instructor commented on how surprises she was by the quality and quantity of the responses. Here are is small sample of responses, representative of the type of student postings:

> I'm not very clear about the principle about using sympathetic stimulation to initiate heartbeat, you know, in today's clinical practices, there is a treatment precaution using sympathetic defibrillator to initiate heart beat to cure the atrial fibrillation, but it's difficult to understand the principle of it, could you explain it for us in a non-academic way? Thank you.
>
> If there is an immune response for body defence in immune system, are there any changes to the cardiovascular and lymphatic systems, such as changes in heart beat rate, blood flow and lymph flow rate? What are the clinical skills for assessing clients' cardiovascular, immune, lymphatic system?

Table 3: Course task plan: Hong Kong taxation

Pre-class tasks to increase **interactivity** and engagement with content: The pre-class task activity will introduce students to the course material to familiarize them with the content before class. Each week students will be given a case example online and asked questions that they will complete and submit online prior to class time. Additional pre-class tasks may be incorporated to modules to include a drag and drop type of matching activity for students to complete prior to class to help them learn terms appropriate to that module. For other modules that require students to learn and order terms, tasks that require them to define and order items relevant to specific legislation will be available online. Module 'X': pre-class task example: Case Example (students will read this online) Miss Chan purchased a residential property in March 2004. It was let out on 1 June 2004 on the following terms: 1 Term of lease: 2 years from 1 June, 2004. 2 Rent: \$15 000 per month for the first year and \$16,500 for the second year (payable on the first of each month). 3 Initial premium: \$225 000 payable on 1 June 2004. 4 Rates \$3 200 per quarter, payable by tenant. 5 Management fee: \$1 900 per month payable by tenant to landlord. Miss Chan paid mortgage interest of \$25 000 per month to the bank in respect of the aforesaid property for a period of 10 years commencing from 1 March, 2004. On line questions: 1 Which of the terms listed in the case example are relevant in computing Miss Chan's property liabilities for the year's assessment 2003/04, 2004/05, and 2005/06? (refer to the text as a resource to help you decide which terms are relevant). 2 Do you have questions about why or why not any of the above terms are relevant? 3 What would you like to ask the tutor about the readings for this module? 4 Prior to class – read through the questions/comments posted by students on the on line forum. Come to class prepared to answer and discuss these questions.
Feedback: Students will post their responses to questions 2 and 3 on the course forum. In this way all students can see the questions raised and the tutor will scan through the forum postings ahead of class time and provide feedback to the questions in the face-to-face tutorial time.
Change in use of class time: The usual paradigm was to cover new material in lecture format and to introduce and complete two cases in class time. There was not enough time in class to address students' questions in class. In the revised format the students were introduced to the content on line and had to use the course material (from the text based resources) to solve the first case example and respond to questions. (* Authors' comment: It is important to note that the students did not have to 'solve' the problem before class – but to select the relevant information that was needed to do the calculations. This was identified in the planning stage as a key obstacle for students' success; they did not know how to select relevant information from the case studies provided.) The course tutor will review the questions and comments posted by student in the forum and use class time to: • respond to questions posted. • taken up the case example that students completed to provide feedback to students on the relevant terms • continue to the next step of the case to do the actual calculation of the tax liabilities • introduced and discussed the second case example
Post class tasks: **Practice**: To reinforce the students' application of the taxation laws, post-class tasks will provide additional exercises for students to complete and receive online feedback. In this example the next step for the students is to do the actual calculations for the case during the tutorial.

Note. This course is in the development phase during the fall term of 2006; implementation will be January 2007.

These responses indicate that the students had read the material, engaged in the discourse of the subject with understanding, and subsequently posed thoughtful questions. The instructor changed the use of class time to respond to the students' questions as part of the lecture. A surprise spin-off from this course-redesign was that the instructor decided to advise the tutorial leader of the nature of the responses so that the tutorial could also be used to provide feedback and practice on areas the students had problems with (in this course, the students have the lecture component from one instructor and the tutorial component from another).

Educational implications

The design of the T5 model encourages a task-based, learning-centred approach to course design. The introduction of this method, in a process-based approach to staff development, allowed instructors to 'rethink' the use of in-class time and out-of-class time. In typical, lecture-based practice, the professor does most of the pre-class work, preparing lectures and power points to deliver content-information to students in class. In a task-based approach, the instructor changes his use of time to spend less time on preparing and delivering content and more time providing feedback and coaching to students about their understanding of the content. This feedback can be provided through online coaching as well as in class coaching and dialogue. We know that students learn, not as passive receivers of information, but through opportunities to reflect upon and discuss ideas. Knowledge arises from: "ongoing conversations about things that matter, conversations that are themselves embedded within larger traditions of discourse that we have come to value" (Applebee, 1996, p.3). If students engage in pre-class tasks they come to class prepared for a rich academic dialogue (Novak, 1999). When students are prepared, the instructor is able to redirect in-class time to incorporate meaningful discussion with feedback about the pre-class tasks.

The applied learning mapping process can significantly reduce the amount of time needed for curriculum development at minimal cost without compromising the creation of an effective learning environment. Although a significant funding allocation ($1 125 000 HK) was made available to be drawn upon for the current group of e- Scholars, the majority have not needed to draw upon this funding.

The e-Scholars Programme, in a short time frame, provides foundational knowledge for teachers regarding the importance of interactions in learning as well as an understanding of how to develop and use a task-based approach that promotes deep learning. Participation in a community of learners maximizes the impact by providing feedback from peers in addition to guidance and feedback from the facilitator/coach. The group approach is particularly useful when the time of the instructional designer is limited. The applied learning mapping process allows the instructor to build on this knowledge by focusing on appropriate application of tasks in the course. In addition, exemplars of learning tasks are shared in the learning community by the cohort of participants; current exemplars can be shared and reused by future participants. The combination of the T5 model and applied learning mapping suggests exciting possibilities for guiding instructors in learning-centred, interactive instructional design.

The institutional trend to expand online course offerings for students, and to use blended learning in most courses offered, provides a unique opportunity for faculty to explore options to engage students with course material through in on-line learning tasks. However, since faculty generally choose the lecture for almost all teaching situations, institutions must commit to providing sound advice in best practice if we expect that blended or online courses will be designed as learning centred and interactive. The e-Scholars program combines a resource effective approach, in terms of financial and time resources with a sound pedagogical framework. The process-based implementation model within a learning community promotes active learning and training to scaffold course development over a period of months during course development phase with guidance in how to use technology tools to promote best practice. If these conditions are met, staff development centres have the potential to change the paradigm from replication of content on line to providing a learning-centred experience that promotes deep learning.

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Design and evaluation of an e-learning environment to support the development and refinement of clinical reasoning and decision-making

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Emerging paradigms of clinical reasoning skills are tending to veer away from linear and clinical competencies towards generic professional skills and decision making processes. In the present study, occupational therapy students have previously complained that they do not receive enough support from the university or their peers during fieldwork placements, when they are expected to demonstrate clinical reasoning skills. Supervisors have observed that occupational therapy students, as novices, have difficulty in demonstrating strong clinical reasoning skills in the fieldwork setting. In this situation, the end-user (i.e. the patient or client) may not receive the optimal level of care and it is therefore imperative to scaffold students' reasoning skills to prepare them as working professionals. This paper will explore the design and evaluation of a moderated online forum to support the development and refinement of clinical reasoning (a form of critical thinking) skills in occupational therapy students undergoing fieldwork placements. An innovative analytic content-based instrument derived from current models of clinical reasoning is applied to a corpus of data to measure students' skills, and on the basis of results obtained, to suggest ways of enhancing the online environment to support emerging decision-making skills among novice practitioners.

Keywords: online asynchronous discussion; clinical reasoning; critical thinking; occupational therapy; health professional education; instrument development

Introduction: Context of the study

Over recent years, the health care service system has undergone rapid and substantial change (Higgs & Hunt, 1999). Service users are demanding that their unique circumstances be acknowledged and considered in the clinical reasoning process. This changing health care context has prompted the review of how clinical reasoning skills are developed and applied by students of the health professions.

In the undergraduate occupational therapy curriculum in this study, students in the third year of their four-year course engage in thirteen weeks of fieldwork in consecutive blocks of six and seven weeks. These fieldwork placements present students with the opportunity to apply their clinical reasoning skills in a real-life setting, taking responsibility for their own group of clients. It is therefore important for students to receive support in their application of these skills. Students in previous years have complained that during these fieldwork placements they did not receive enough support from their peers or university staff to support them in putting the clinical reasoning process into practice.

The expansion of web-based teaching tools opened new opportunities and new ways to provide support to these students. On the whole, occupational therapy students appreciate the convenience and flexibility provided by web-based teaching tools (Scanlan & Hancock, 2005). The use of web-based tools to allow students to provide support to each other during fieldwork was a way of handing over ownership of this technology to the users. With structure provided by educators, students are able to utilise this technology to support one another and learn together in their collective application of clinical reasoning skills.

It was considered that the provision of support via online asynchronous discussions would be one way of supporting students to achieve the learning outcomes associated with this fieldwork, some of which included:

- demonstration of the importance of client/service user perspective in occupational therapy practice
- utilisation of best practice and evidence based practice to plan, implement, and evaluate relevant occupational therapy services in collaboration with supervisor
- demonstration of an awareness of the value and importance of life long learning in their professional development
- development of professional reasoning skills and professional persona e.g.: values, confidence, skills and accurate self-assessment
- reflection upon fieldwork experiences demonstrating a deeper level of understanding of its significance compared to previous placements/years.

This paper reviews the implementation and effectiveness of these online asynchronous discussions in supporting students to apply their clinical reasoning skills whilst on fieldwork. It explores how our students use technology to support their learning and explores how educators may learn to use this technology to more effectively meet the learning needs of students undertaking fieldwork placements.

Literature review

Critical overview of the links between critical thinking and clinical reasoning

Clinical reasoning is a form of critical thinking employed in the context of health care service provision. The development of critical thinking skills lies at the core of all educational programs at the tertiary level and this is especially important in the development of student health professionals who will enter a rapidly changing and demanding healthcare environment.

Francis Bacon defined critical thinking as "the skillful application of a repertoire of validated general techniques for deciding the level of confidence you should have in a proposition in the light of the available evidence" (Austhink, 2006). One of the most pressing issues in education is to discover how to support intellectually productive interaction and foster critical thinking and higher forms of cognition, such as those competencies outlined by Brookfield (1987) and by Hager, Sleet, Logan and Hooper (2003). These competencies can include: making reasoned decisions in problematic situations; adapting to change; reasoning and thinking critically; collaborating productively in groups or teams; learning independently; seeing multiple perspectives; and solving problems.

When considering higher-order thinking, theorists may differ in the definitions they offer, but agree that it means the capacity to go beyond the information given, to adopt a critical stance, to evaluate, to have metacognitive awareness and problem solving capacities. Having the capacity to be an autonomous thinker and make reasoned judgements is the quality that most often emerges in the literature discussing higher order thinking (Lipman, 1991; Paul, 1993). Much current debate surrounds how to create optimal conditions in online environments for productive interactions that lead to higher order cognition and enable learners to develop as independent thinkers. Most research on computer mediated conferencing has been positive about its potential and capacity to provide a social and supportive climate for learning (Garrison, Anderson & Archer, 2000; Jonassen & Kwon, 2001).

Recent research on forms of productive interaction in online environments is linked to socio-cultural theory (McLoughlin & Luca, 2006) as this has been found to be robust and flexible in accounting for group and individual processes in computer conferencing environments. The theoretical basis for a great deal of research on thinking is derived from a cluster of theories relating to communicative, socially-based practices in learning. The recognition that learning and everyday cognition are tied to language use has influenced theorists to pay close attention to the influence of social processes on learning and to socio-cultural theory (Resnick, Levine & Teasley, 1991; Coles, 1995). According to sociocultural theory, dialogue in a learning setting plays an important part in helping learners to internalise ideas and knowledge from the social plane. Learning is advanced when tasks are pitched just beyond the learners' level of independent ability but still within their reach with outside support or assistance. In order to advance the learner towards more complex forms of understanding, scaffolding can be provided by peers and others. Whereas much of the research applying Vygotsky's work has been based on the asymmetric interactions of teachers and learners, contemporary research is also investigating the interactions in more symmetrical learning environments involving learners working collaboratively (McAteer, Tolmie, Duffy & Corbett, 1997). The interactions that occur among peers in computer conferences are legitimate forms of scaffolding that offer opportunities and support for cognitive development. When learners have to explain ideas to each other, a more explicit and organised understanding can result (Repman, 1993). This form of co-construction leading to cognitive change is critical to the development of higher order thinking processes.

Reflection is a key element of clinical practice, interaction and learning and has been emphasised by many theorists and practitioners. Dewey (1933) first emphasised the importance of reflection based on experience. The seminal works of Schön (1983, 1987, 1995) suggested that reflection, the ability to engage in a process of continuous self-evaluative learning, was a crucial feature of professional practice. He was opposed to professional training models of 'Technical Rationality' – which involved giving participants materials to apply later in the world of professional practice. Reflection requires "restructuring, theories of phenomena, or ways of framing the problem" (Schön, 1987, p. 35) and Schön (1987) saw 'knowing-in-action,' 'reflection-on-action' (after the event) and 'reflection-in-action' (during the event) as "increasingly complex components of reflective practice" (p. 123). The cultivation of reflective abilities has become a critical element of education for students of the health professions.

Clinical reasoning in the health professions

Traditional methods of clinical decision making in the health professions have been criticised for failing to take into consideration the unique context of the individual. Such methods include pattern recognition (relying on a strong knowledge base to determine intervention given the client's clinical presentation) and hypothetico-deductive reasoning (refining hypotheses through further investigation using an "if… then" progression) (Higgs & Jones, 2000).

Recent developments in theory about clinical reasoning in the health professions suggest that education needs to be tailored to support the development of students into professionals capable of interactional clinical reasoning and decision making (Higgs & Hunt, 1999). They refer to this as the "interactional professional." The interactional professional is responsive to the unique needs of the client in their own unique context. Higgs and Hunt (1999) provide an operational definition of the interactional professional as a health professional who "combines the key notions of competence, reflection, problem solving and professionalism, with three other practice concepts, social responsibility, interaction and situational leadership" (p. 15).

Stated simply, clinical reasoning refers to thinking and decision making processes that are integral to clinical practice. More specifically, clinical reasoning refers to the process of reflective inquiry. Mattingly and Fleming (1994) further explain that clinical reasoning is a way of thinking and reasoning that "involves deliberation about what an appropriate action is in this particular case, with this particular client, at this particular time" (pp. 9–10). The integration of the concept of the "interactional professional" with previously devised models of clinical reasoning lead to the development of a new model of clinical reasoning for the health professions (Higgs & Jones, 2000). This model (presented in Figure 1) underpins the fieldwork curriculum offered to students in the current study and informed the primary learning outcomes for students in the case study described in this paper.

This model integrates the different demands and expectations of modern health care services. Each loop of the model represents "data input, data interpretation (or re-interpretation) and problem formulation (or re-formulation) to achieve a progressively broader and deeper understanding of the clinical problem" (Higgs & Jones, 2000, p. 11). The model also integrates six elements critical to the clinical reasoning process described as:

- cognition or reflective enquiry

- a strong discipline specific knowledge base
- metacognition, which provides the integrative element between cognition and knowledge
- Mutual decision making, or the role of the client or patient in the decision making process
- contextual interaction, or the interactivity between the decision makers and the situation or environment of the reasoning process, and
- task impact, or the influence of the nature of the clinical problem or task on the reasoning process. (Higgs & Jones, 2000, p. 10)

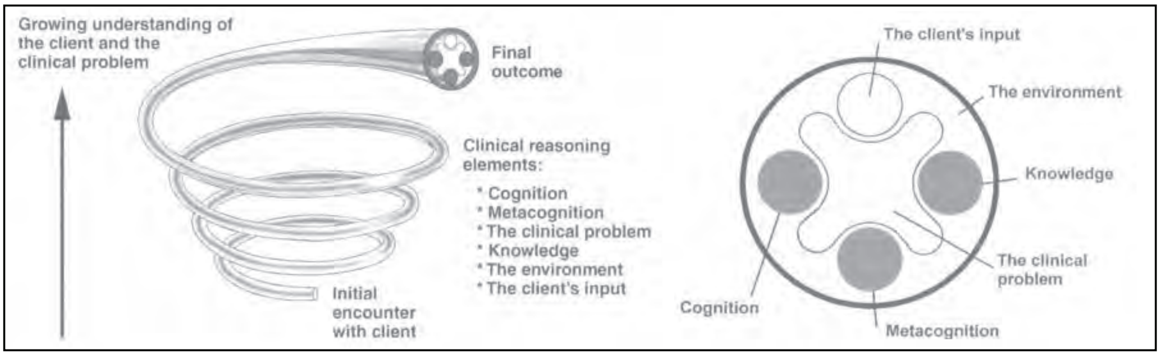

Figure 1: Model of clinical reasoning for the health professions
(Reprinted by permission from Higgs & Jones, 2000, p. 11)

E-learning environments to support clinical reasoning skills

The use of online asynchronous discussions was considered to be a useful way to mobilise support from peers for occupational therapy students undertaking fieldwork placements. Peer support had previously been identified as an under-utilised resource in this context. In 2004, asynchronous online discussions were introduced to the second of two third year fieldwork placements. In this form, students were required to respond to trigger questions focused on their experiences of the placement: how they found the supervisory style, their feelings about their performance and their supervisor's assessment of their practice, as well as reflection upon difficult or challenging situations. There were not specific, structured opportunities to discuss clinical problems or engage in peer to peer learning surrounding clinical reasoning.

In 2005, a new format was introduced. In the first, second and final weeks of fieldwork, students were engaged in similar descriptive and reflective discussions but in the middle weeks of the placement, students were grouped into five clusters according to fieldwork setting and engaged in clinical case discussions. It was expected that these clinical discussions would assist students in the development and refinement of their skills in clinical reasoning.

The structure for the clinical case discussions section was presented to the students as follows:

> Engage in a case discussion about a client in an area similar to that of your placement area. Some students will choose to open a discussion by posting a "client outline", according to these specific criteria: age; diagnosis; assets/ strengths; limitations; occupational performance problems; further information required; and ideas for treatment plan.
>
> These client outlines will be the basis of further discussion. Each student is expected to provide additional suggestions by way of at least two postings. Postings this week should cover such areas as: things you might have attempted with similar clients; suggestions for further assessments; general discussion about treatment options for clients with this particular diagnosis; and suggestions for specific treatment interventions.

As this was the first implementation of clinical case discussion forums, the format for ongoing discussion was presented with minimal structure. This was intended to give some freedom to the students to allow them to utilise the forums in the ways which best met their needs. It was expected that the opportunity to engage in discussions with peers and receive feedback would generate a strong clinical reasoning through collaborative action. Discussions were moderated by fieldwork educators from the university and weekly contributions from students were compulsory.

Data analysis

Method and instrument development

Ethics approval for this study was obtained from the Human Research Ethics Committee of the first and third authors' university. De-identified transcripts from the clinical discussion forums from the first six week fieldwork period were collated for analysis. Initially, the discussions were analysed using Murphy's (2004) instrument for analysis of critical thinking in online asynchronous discussions. A pilot analysis of a random selection of 140 postings was conducted by the first and third authors. This pilot revealed significant limitations of this instrument in this context. Most significantly, this tool was found to be unable to accurately identify a critical feature of clinical reasoning, that is, the exploration of the individual's unique context and situation as described by Higgs and Jones (2000).

Following the completion of the pilot study it was determined that it was important to more accurately capture the important elements of clinical reasoning evidenced in the discussions. Whilst a number of authors have discussed methodological approaches for increasing inter-rater agreement (Oriogun & Cook, 2003) and for the analysis of online interactivity (Fahy, 2005; Oriogun, 2003), no methods were found that allowed for the analysis of clinical reasoning in the health care context. In this study, discussion messages were used as artefacts for the analysis of clinical reasoning processes. A hybrid instrument was therefore developed, integrating elements from the instrument for analysis of critical thinking (Murphy, 2004) and the model of clinical reasoning for the health professions (Higgs & Jones, 2000).

Murphy's instrument contained five broad categories and is summarised in Table 1.

Table 1: Instrument for the analysis of critical thinking in online asynchronous discussions (Murphy, 2004)

Recognise	Recognising or identifying an existent issue, dilemma, problem, etc.
Understand	Exploring related evidence, knowledge, research, information and perspectives
Analyse	Seeking in depth clarification, organising known information and dissecting the issue, dilemma or problem into its fundamental components
Evaluate	Critiquing and judging information, knowledge or perspectives
Create	Producing new knowledge, perspectives, or strategies and implementing them or acting on them

The hybrid instrument retains three broad categories from Murphy's instrument, namely understand, analyse and evaluate. Recognise was removed, as in the clinical environment, the health professional is presented with the problem as the client, their family, or another person has recognised the problem. The clinical decision making process typically begins with the development of understanding.

The understand category was retained, but expanded in the hybrid instrument to more fully analyse the required considerations that must be made by the health professional or student to fully understand the client's unique circumstances. Following Higgs and Jones' (2000) model, these elements of understanding are labelled as clinical problem, knowledge, client's input and environment.

The create category was replaced by two further categories. These categories are metacognitive reasoning and decision making. As presented in the Higgs and Jones (2000) model, clinical reasoning involves deepening and widening understanding, analysis and evaluation that incorporates metacognitive elements to guide decision making. Metacognitive reasoning is considered to be a crucial step prior to effective decision making and is therefore included as a separate category in the hybrid instrument. This hybrid instrument is presented in Table 2.

Two additional codes were also used in the analysis. The first of these codes, "no response", was used where the message did not contain an element of clinical reasoning. Most often these messages were to express gratitude to other students for the provision of information, but there were also messages where students discussed individual frustrations not related to specific clinical issues. The other code was "moderator comments", which indicated input from a university staff member.

Table 2: Hybrid instrument for the analysis of health professional clinical reasoning

Category	Code	Description	
Understand	U-P	Clinical problem	"The influence of the nature of the clinical problem or task" (Higgs & Jones, 2000, p. 10)
	U-K	Knowledge	Diagnostic and profession-specific knowledge
	U-I	Client's input	Input from the client in the decision making process, including their preferences
	U-E	Environment	"The interactivity between the decision makers and the situation or environment of the reasoning process" (Higgs & Jones, 2000, p. 10) as well as the influence of the client's unique environment
Analyse	A	"Seeking in depth clarification, organising known information and dissecting the issue, dilemma or problem into its fundamental components" (Murphy, 2004)	
Evaluate	E	"Critiquing and judging information, knowledge or perspectives" (Murphy, 2004)	
Metacognitive reasoning	M	The integrative element between knowledge and information gathered through reflective enquiry and deep understanding of the unique situation and context of the client	
Decision making	D	Sound judgements and decisions on intervention strategies	

A total of 263 individual messages were analysed. These consisted of full threads drawn from discussion forums in all clinical areas. Postings were coded by the first author using the hybrid instrument as described above. The use of a single rater is acknowledged as a limitation of this exploratory study. The unit of analysis was selected as the syntactic unit of the whole message as it has been suggested to be more reliable and efficient than other semantic units of analysis (Murphy & Ciszewska-Carr, 2005). Messages were coded according to the different elements of clinical reasoning present. As clinical reasoning is a process, it is neither possible nor useful to rate the "highest" level of reasoning achieved. From the 263 original messages, a total of 314 (using the single broad category of "Understand") and 416 (using the more specific categories within "Understand") codes were assigned.

Results

Table 3 presents the results of the analysis, where the broad category of "Understand" was used in analysis. Although limited, this method of data representation allows for broad comparison to the results of other studies investigating critical thinking in online asynchronous discussions.

Table 3: Clinical reasoning in messages by broad categories and clinical area

	Acute (*n*=85)	**Project (*n*=84)**	**Rehabilitation / Community (*n*=91)**	**Paediatrics (*n*=55)**	**Mental Health (*n*= 79)**	**TOTAL (*n*=314)**
Understand	76%	44%	83%	67%	56%	65%
Analyse	5%	10%	3%	4%	5%	5%
Evaluate	13%	8%	10%	16%	10%	11%
Metacognitive Reasoning	2%	11%	0%	4%	13%	6%
Decision Making	0%	3%	0%	2%	3%	2%
No Response	5%	23%	0%	7%	13%	10%
Moderator Comments	0%	1%	4%	0%	2%	2%

Further detail about the clinical reasoning demonstrated in the messages is revealed when the "Understand" category is further separated into its constituent elements. Figure 2 presents how many messages included consideration of the various elements required for deep understanding of the clinical situation. Figure 3 illustrates the frequency of consideration of each individual element of the understanding category.

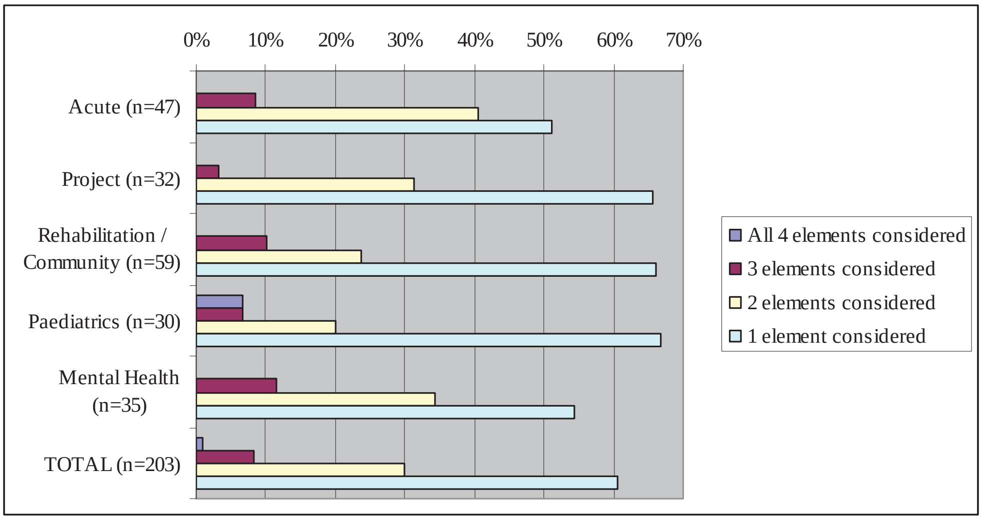

Figure 2: Number of understand elements considered by clinical area

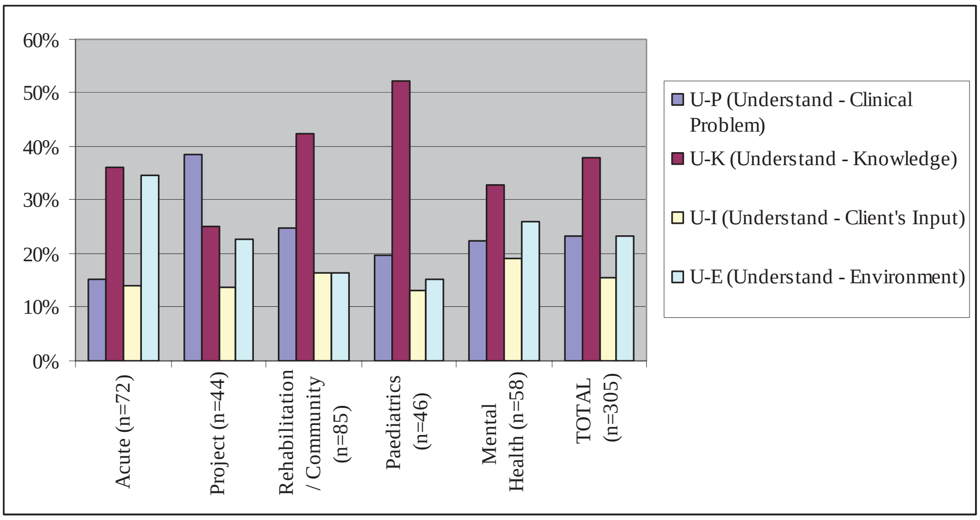

Figure 3: Elements of Understand category by clinical area

Discussion: who's learning and where are they learning?

These data demonstrate that the provision of opportunity for clinical discussions was not enough to support students in their development and demonstration of clinical reasoning skills. The expectation that the collaborative learning environment would provide sufficient scaffolding for this process was not realised. As with other studies investigating critical thinking, there was a predominance of responses in the "understand" category (Murphy, 2004).

Nevertheless, student discussions did demonstrate consideration of a wide range of contextual factors integral for the development of individualised interventions that consider the unique circumstances of the individual. This is highlighted in Figure 3. Traditional models of clinical decision making have focussed upon pattern recognition and hypothesis testing. These models rely on broad understanding of the clinical problem and profession-specific knowledge, but do not consider the input of the client or environmental factors. Whilst there was a predominance of messages including the element of knowledge, peer involvement in the discussion regularly reinforced the importance of considering the opinion of the client and their environmental context. This was a clear advantage of this method of peer-supported learning.

The use of the hybrid instrument for analysis of clinical reasoning was also very useful in this study. The instrument revealed significant and important information about the quality of clinical reasoning engaged in by the students, both in individual messages as well as overall. The results shown in Figures 2 and 3 highlight the additional utility of the hybrid instrument over the generic instrument (Murphy, 2004) used in the pilot. This allows us to analyse the quality of students' understanding of the clinical situation (most especially in terms of breadth), which was the primary shortcoming of the original instrument.

Clinical reasoning in different settings

Different clinical settings appear to influence the clinical reasoning processes demonstrated by students.

In the acute hospital setting, there is a typical pattern of short admissions with a focus upon discharge planning. In this setting there is often limited opportunity to conduct detailed assessments. The significant focus upon "understanding" in these discussions is therefore not unexpected as students and practitioners focus on gathering information to assist in pattern recognition and provision of the most appropriate equipment and services. Student discussions reflected this, with many messages containing suggestions of services or equipment provided to similar clients. This context may have limited students' ability to analyse or critique clinical information. This was verbalised by students who expressed that they felt pressured to make quick decisions without fully understanding the individual situations of their clients.

Students engaged in project placements act as consultants. They are provided with broad objectives and are required to design and implement strategies to achieve their goals. These settings tend to challenge students to find their role and to discover how their professional skills can be put into practice. Discussions within the project forum were less skewed towards a simple understanding focus. Students demonstrate higher than average levels of analysis, evaluation and metacognitive reasoning. This can be considered an artefact of their need to discover and evaluate their role and contribution in these settings. Ill-structured problems such as those encountered in some project-based fieldwork placements have been reported to assist in the development of critical thinking in a variety of student populations (Cheung & Hew, 2004; Cheung, Tan, & Hung, 2005). Nevertheless, students did seem to be most frustrated in these settings, reflected by the high number of messages rated as "no response." These messages tended to consist of students venting their frustrations associated with the 'ill-defined' nature of the placement.

Similar to project-based fieldwork, mental health settings appeared to promote greater levels of evaluation and metacognitive reasoning demonstrated in student messages. Clients of mental health services tend to have multiple needs and their complex presentations tend to thwart any attempt to apply model solutions. These circumstances challenge students to develop a comprehensive understanding of their clients' unique circumstances and perspectives. This was highlighted by the relatively even distribution of the different elements of understanding and most especially the high level of input from the client themselves.

Lessons about e-learning and e-teaching: future directions

This paper examined the use of online asynchronous discussion forums to support the development and refinement of clinical reasoning in a group of third year occupational therapy students undertaking fieldwork placements. A hybrid instrument to assist in the analysis of clinical reasoning in discussions was also developed and trialled.

Our hypothesis that student collaboration in the clinical discussion forums would provide suitable scaffolding for the demonstration of the full process of clinical reasoning was not supported. Further development of structures and academic scaffolding around the clinical discussions will be required to assist students in their development and application of clinical reasoning skills in real-life settings.

The initial instructions may have encouraged students to take a more superficial approach when making suggestions to their peers. Although other information within the unit encouraged students to explore for evidence in the literature and analyse and critique perspectives, the instructional message did not include explicit reference to these requirements. Additional structures that could be incorporated could include the use of a clinical reasoning proforma to guide student messages and further explanation of the purpose of the discussions as forums to refine and develop clinical reasoning skills.

Lessons learnt from this study (such as the need for significant amounts of structure and educator-implemented scaffolding to develop and refine clinical reasoning skills in the discussion forums) have applicability well beyond the education of occupational therapists and other health professionals. Findings regarding this method of e-teaching may allow this technology to be used more effectively in a range of scenario-based educational environments.

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Impact on student learning: Student evaluations of online formative assessment in fluid mechanics

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This paper looks at the way in which students in core second and third year units of study are using a set of automated practice calculations which have been developed with automatic marking and feedback, and prepared and delivered online. The calculations are in spreadsheet format and are downloaded by students from a *WebCT* site. Every time students open a file they are presented with a new set of data to practice on. These calculations were introduced into a 2nd year unit in semester 2 2005 and a 3rd year unit in semester 1 2006. The students' use and perceptions of use in general were correlated with student performance on complex calculations questions in the final examination. The results of this analysis will: a) improve the student learning experience in relation to the way in which the online resource is being used to complement face-to-face teaching; b) develop a model for the provision of online automated practice activities to be made more widely available throughout the School of Civil Engineering and the wider University.

Background

Second and third year fluids engineering students experience difficulty developing fundamental knowledge and skills before entering their senior years. This is particularly evident in units of study where complex technical calculations are a core component and students need to make appropriate use of a number of concepts to solve problems with many variables under a broad range of circumstances. They also need practice applying formulas to real situations. Traditionally, these students have attended lectures and tutorials, accessed course materials online and obtained paper-based practice materials and answers. However, these practice materials have not included feedback with hints to help students choose appropriate calculations, or to make repeat attempts at solving problems. Additionally, students are unable to easily observe the sensitivity of the output to the input parameters, essential for engineering.

We sought to develop practice activities which would lead students to interact more fully with the learning materials and develop a deeper understanding of the content. The School of Civil Engineering received elearning project support from the University initiative 'USyd eLearning' to develop automated practice activities in 2005 and 2006. These activities became available to second year students in second semester 2005, and third year students in first semester 2006. Discussions are currently underway in the School to apply these activities to other courses with minor modifications and different technical material.

The activities described in Wood and Ward. (2006) enable students to make multiple attempts at each problem. Instant feedback provides increasing levels of assistance at each repeat attempt until the third attempt, when students are directed to the correct answer in the course text. Each question is scaffolded into two or three parts which develop students' basic knowledge, fundamental theory, and skills and knowledge with numerical calculation. This scaffolding follows Biggs' (2003) SOLO taxonomy, as students are required to use an increasing level of understanding as they move from basic to higher order thinking. A range of variables have been used to develop a number of variants of each practice activity - these are randomly generated every time students open the practice activities so students can practise as many times as they wish. The spreadsheets also improve students' generic computer skills in laying out spreadsheets in a logical and structured manner, and involve some of the more advanced features in Excel.

The concept of using Excel extends from the original work conducted by lecturers in the Faculty of Economics and Business, The University of Sydney, who had previously created problems for their students' summative assessment (Blayney & Freeman, 2004). However, their calculations were relatively simple compared to those in engineering; since summative rather than formative, their code provided higher security to prevent cheating; and automatic downloading and marking modules were developed.

The merit of our research into the students' use and perceptions of use of the complex calculations is to improve the student learning experience in relation to the way in which the online resource is being used to complement face-to-face teaching, and to develop a model for the provision of online automated practice activities to be made more widely available throughout the School and the wider University.

Introduction

The educational research literature shows that students who make use of every learning opportunity approach the final assessment tasks with a greater likelihood of high performance outcomes (for example, Buchanan, 2000; Zarkrzewski & Bull, 1999). Research conducted in the School of Biological Sciences at The University of Sydney has demonstrated that students who use online formative assessment opportunities are more likely to outperform others who do not use them (Peat, Franklin, Devlin, & Charles, 2004). Moreover, Blayney and Freeman (2004) have found that the use of timely and effective feedback in assessment is crucial for learning. However, whilst they have found students want more feedback, increasing class sizes means academics are finding it difficult to find the time to provide it: the second year core unit of study in Civil Engineering has gone from 85 students in 2001 to 190 students in 2006.

This paper looks at the way in which students' use of online automated practice activities with automated feedback may influence the way they learn the content of core second and third year engineering units of study. Our hypothesis is that online practice activities which provide automated feedback and allow students to work at their own pace and at a time which suits them can increase students' learning rate.

Methodology

Seventy-four student evaluations of the online automated practice activities from the second and third year undergraduate units were obtained in semester two 2005 and semester one 2006. The 49 second year responses made up 29% of the student cohort. Of these, 84% were males, the mean age was 20, 100% were enrolled full-time and 92% primarily accessed their online learning materials from home. The 25 third year responses made up 15% of the student cohort. Of these, 92% were males, the mean age was 21, 92% were enrolled full-time and 84% primarily accessed their online materials from home.

Students were surveyed in the final week of semester with a qualitative and quantitative questionnaire which investigated usage of online automated practice activities and the perceptions of the usefulness of these. Completion of the questionnaire was voluntary. In addition to demographic questions, the questionnaire contained: two subscales about the functional and educational aspects of the resource, to which students responded on a 5-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'; questions assessing how the resource could be improved and overall satisfaction. The WebCT tracking facility was also used to identify a qualitative measure for access to the materials by students and this measure was correlated with the measure of answers to the complex calculations in the final exam.

Results

To assess students' evaluation of the automated practice calculations, analyses were grouped according to the three major sections of the questionnaire. Responses of 'agree' and 'strongly agree' were merged, as were 'disagree' and 'strongly disagree'. Responses on the questions assessing the functional and educational aspects of the automated practice calculations are shown in Tables 1 and 2.

The results show most students had little difficulty using the activities, and either agreed or were non-committal that the 'Read me' file was useful, the resource helped them improve their Excel skills and the resource helped them understand the content of their unit of study. Students were fairly evenly distributed in their evaluation of the usefulness of the feedback and clues. Accordingly, we have redeveloped these in the updated version of the resource to make them more useful. Responses to the question assessing the overall satisfaction with the online automated practice calculations are shown in Table 3.

Table 1: Survey responses to questions related to functional aspects of the online resource

Survey question	Second year	Third year
Q7: The 'Read me' file helped me to start using the automated practice calculations (APC)	46% Strongly agree/agree* 49% Neutral 5% Disagree/strongly disagree	44% Strongly agree/agree 56% Neutral 0% Disagree/strongly disagree
Q8: I had no technical difficulties downloading the APC file	72% Strongly agree/agree 18% Neutral 10% Disagree/strongly dis.	88% Strongly agree/agree 0% Neutral 12% Disagree/strongly disagree
Q9: I found the APC easy to use	54% Strongly agree/agree 28% Neutral 18% Disagree/strongly dis.	66% Strongly agree/agree 27% Neutral 7% Disagree/strongly disagree
Q10: The APC helped me improve my ability to use Excel spreadsheets	31% Strongly agree/agree 46% Neutral 23% Disagree/strongly dis.	31% Strongly agree/agree 56% Neutral 13% Disagree/strongly disagree

Note. * Likert scale response choices: strongly agree/agree/neutral /disagree/strongly disagree

Table 2: Survey responses to questions related to educational aspects of the online resource

Survey question	Second year	Third year
Q11: The APC helped me understand the principles of fluid mechanics	51% Strongly agree/agree 41% Neutral 8% Disagree/strongly disagree	65% Strongly agree/agree 24% Neutral 11% Disagree/strongly disagree
Q12: The feedback in the APC helped me understand any errors I had made in the calculations	39% Strongly agree/agree 41% Neutral 33% Disagree/strongly dis.	25% Strongly agree/agree 38% Neutral 37% Disagree/strongly disagree
Q13: The clues provided in the APC helped me answer the calculations correctly	36% Strongly agree/agree 56% Neutral 31% Disagree/strongly dis.	44% Strongly agree/agree 25% Neutral 31% Disagree/strongly disagree
Q14: The APC helped me get more out of my fluid mechanics unit of study this semester	44% Strongly agree/agree 41% Neutral 13% Disagree/strongly dis.	29% Strongly agree/agree 59% Neutral 12% Disagree/strongly disagree

Table 3: Survey responses to overall satisfaction with the online resource

Related survey question	Second year	Third year
Q16: All things considered, I would rate the APC as: Excellent, Good, Satisfactory, Poor, Very poor	3% Excellent, 61% Good 32% Satisfactory 4% Poor, 0% Very poor	13% Excellent, 56% Good 25% Satisfactory 6% Poor, 0% Very poor

These positive results demonstrate that the resource is appreciated by students. In the questionnaire students were also asked how the resource could be improved. The largest proportion of responses (39% in second year and 29% in third year) suggested providing more detailed feedback for incorrect as well as correct answers. Other suggestions included making the resource compulsory and awarding marks, with one student writing, "Not enough time… unless the work gets marked I don't do it!!"

The correlation between students' access to the materials and their answers to the complex calculations given in the final exam was identified. Analysis of the second year cohort shows a slight positive trend in the correlation between the number of times students accessed the resource and their results on the final exam. Interestingly, analysis of the third year cohort shows a definite trend, Figure 1, between the results in the final exam and their efficiency in accessing the data; calculated by the number of questions downloaded divided by the total number of downloads. This is statistically significant with an F factor of 15. Results from both years show a slight shift in the number who failed to the number who passed, however, this can not be statistically isolated from other factors, Figure 2.

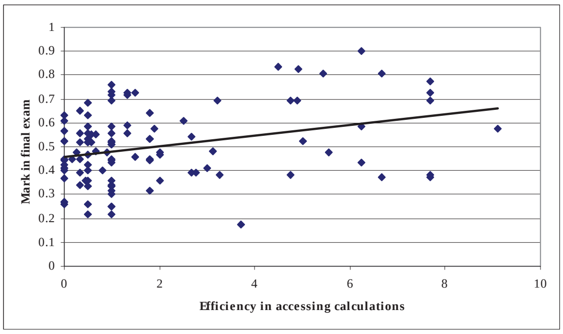

Figure 1: Final exam mark versus attempts

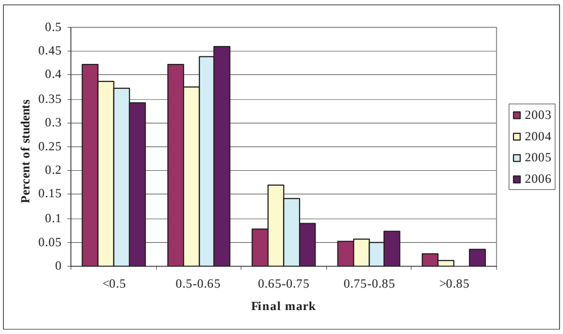

Figure 2: % of students versus overall mark

Conclusion

Initial feedback from students about the online automated practice activities has been positive, with the request for more extensive feedback on incorrect and correct answers. This confirms the findings of Blayney and Freeman (2004) that students appreciate timely and effective feedback in formative assessment. However, we have found the downside of providing more feedback is that students believe they can fully understand a topic from short automated feedback rather than referencing the detailed notes or text. Despite this, more detailed feedback has been incorporated into the VBA code. Also, for this semester it has been made compulsory for students to complete two of the ten activities.

The correlation of usage of the resource and final exam results confirms the findings of Peat, *et al.* (2004) that students who make use of formative assessment resources achieve better results than those who do not. Future evaluations will determine the effectiveness of improvements to the resource and compare the measure of the answers to similar questions between the 2006/7 and 2004/5 student cohorts. Finally, recognition of the usefulness of the resource is contributing to cultural change in The School of Civil Engineering. It has helped inform an analysis of the Bachelor of Engineering curriculum aiming to improve generic computer skills, and will be taken up as a resource across a number of units of study.

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Design-based research and the learning designer

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The role of the learning designer has expanded from the commonly known activities of an instructional designer to incorporate a range of new roles, largely prompted by new technologies. In this paper, we articulate an approach that further extends the role of the learning designer to encompass evaluation and design-based research, in collaboration with the subject matter expert. Such collaboration is professionally enhancing for both parties, and adds to the sum of knowledge on the effective design of learning environments, by documenting and disseminating the learning design process.

Keywords: learning design, instructional design, design-based research, evaluation

Introduction

In the current climate of increased accountability and quality assurance in higher education, the role of the learning designer is crucial in supporting academics to develop quality products in online, blended and face-to-face university courses. The learning designer (LD) usually works closely with a subject matter expert (SME) or university teacher, and possibly a team of other experts, to develop a classroom-based or technology-based learning environment. Much expertise and intellectual effort is invested in these collaborations using contemporary learning theory and best instructional design practice to underpin practical designs that consider the local context. The close partnership between the learning designer and the SME often results, not only in a product of excellence, but also in the discovery and implementation of design principles that could be disseminated beyond the context of their initial use. Often this wisdom is lost with the completion and implementation of the learning environment, when the focus moves to the teacher's operation, and the learning designer's role diminishes or ceases.

In this paper, we describe an approach to the expansion and extension of the traditional role of the learning designer to encompass evaluation and design-based research, in collaboration with the SME. Such collaboration is professionally enhancing for both parties, and importantly adds to a knowledge base on the effective design of learning environments – by documenting and disseminating the learning design process – and the creation of design principles to achieve valued learning outcomes and to benefit the profession as a whole.

Instructional designer to learning designer

The role of the instructional designer has largely grown and evolved from the systems approach delineated by instructional design theorists such as Gagné, Briggs and Wager (1992) and Dick and Carey (1990). Kenny, Zhang, Schwier, & Campbell (2005) analysed instructional design (ID) and instructional systems design (ISD) theories that can be traced back to work of Robert Gagné. These models of instructional design began to proliferate in the 70s, and by 1980, over 60 such models existed. Kenny et al., found that these models were largely linear and systematic, but concluded: 'Few if any designers actually use models to confine their practice' (para 1). Instructional designers spend much of their time completing the tasks now popularly (and generically) known as the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation. There is a great deal of research that has shown the role of the instructional designer is diversifying and expanding to encompass a range of tasks beyond those prescriptively described in a systems approach (Visscher-Voerman & Gustafson, 2004). The movement to more constructivist learning environments in higher education has also changed the traditional instructional design role, and this is perhaps evident in the change of title that is preferred by many such practitioners – from instructional designer to *educational designer* or *learning designer*.

Constructivism and the web: The changing role of the learning designer

The movement from linear, closed system learning designs to more constructivist approaches has expanded the activities that a learning designer undertakes, and now incorporates activities such as: providing advice on pedagogical principles (Liu, Gibby, Quiros, & Demps, 2002); supervising personnel, professional meetings, academic research, marketing/sales, and professional development (Cox & Osguthorpe, 2003); evaluating learning materials (Wilson, 2005; Allen, 1996); acting as surrogate students (Roberts, Jackson, Osborne, & Somers Vine, 1994); and project management (Kenny, et al., 2005). However, the role of the learning designer also encompasses a range of much more prosaic tasks, such as: advising on writing style and readability (Roberts, et al., 1994); proofreading, designing layout and appearance of materials, and checking copyright issues (Allen, 1996). The growing trend of web courses has also led to the development of learning design roles that are targeted to the affordances of web-based delivery. Such approaches focus the efforts of a learning designer on activities such as: team development, appropriateness of technology to address learning needs, formative evaluation in the form of iterative feasibility testing, technology training for learners, development of policies for ownership of materials (Bichelmeyer, Misanchuk & Malopinsky, 2001); and determining the *pedagogies*, *resources*, and *delivery* strategies of a learning environment (Herrington, Herrington, Oliver, Stoney, & Willis, 2001). Others have provided in-depth exemplars and templates of learning designs for a range of approaches, such as rule-based, incident-based, strategy-based, and role-based designs (Oliver, Harper, Hedberg, Wills, & Agostinho, 2002; Learning Designs, 2003).

Limitations and real-world constraints

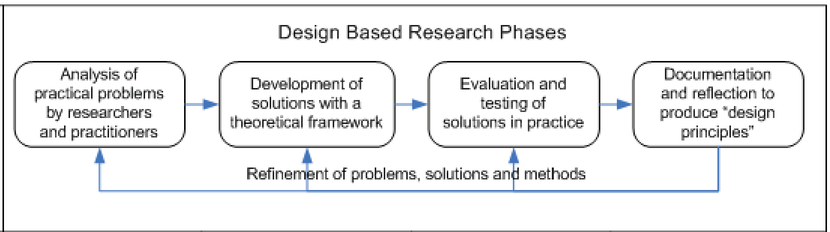
In reality, the specific expertise and contribution that a learning designer brings to any particular learning environment is often determined more by their own particular context and work environment than by any adherence to a procedural or theoretical model of instructional design. For example, in the Australian higher education context, access to a learning designer is limited and often competitive. Any teacher wishing to acquire this expertise must compete with others for a timed and costed service, often termed a *service-level agreement*. In effect, the level of service is limited to those aspects of a course that occur in the analysis, design and development stages rather than the implementation and evaluation stages. Critically, learning designers usually have little opportunity to evaluate the learning environments that they have been instrumental in creating, as they are, of necessity, moved to the next project once implementation is achieved. Such failure to employ evaluation functions in all stages of a learning design can result in ineffectual and unsatisfactory learning environments for both teachers and students. As noted by Reeves and Hedberg (2003): ‘Decisions informed by sound evaluation are better than those based on habit, ignorance, intuition, prejudice, or guesswork … far too often people make poor decisions about the design and implementation of interactive learning systems because they lack pertinent information’ (p. 5).

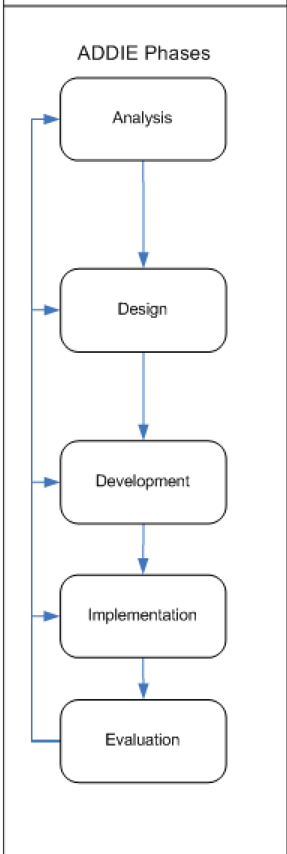
Evaluation as a critical role for learning designers

Reeves and Hedberg (2003) describe six functions of evaluation that can be conducted throughout the life of a project: *review, needs assessment, formative evaluation, effectiveness evaluation, impact evaluation*, and *maintenance evaluation*. While noting that these evaluation functions are only rarely effectively employed in learning systems design and development, they urge instructional designers and developers to go even further: ‘We argue that … instructional designers, project managers and evaluators can do more than simply conduct evaluations; they can extend the reach of their evaluations and contribute to design principles regarding interactive learning systems through a process called development research’ (p. 280). Development research, also known as *design experiments* and now more commonly as *design-based research*, is a research approach that is particularly suited to the exploration of significant education problems and technology-based solutions – the kind of challenge faced every day in the working life of a learning designer. The design-based approach (Brown, 1992; Reeves, 2000; van den Akker, 1999) comprises four phases depicted in the first row of Figure 1 (Reeves, 2000).

Design-based research and the learning designer

A learning designer is often employed to work on a project in higher education as part of a semester course or subject, rather than an entire degree. In such a context, where a specific educational problem can be identified and an appropriate solution implemented, principles of design-based research can be readily employed to guide the efforts of the learning designer and SME to the development of on-going and valuable design principles for future practice. In Figure 1, we have mapped the phases of design-based research against the generic stages of a learning design (the ADDIE phases), and the six evaluation functions described by Reeves and Hedberg (2003).





ADDIE Phases	Analysis of practical problems by researchers and practitioners	Development of solutions with a theoretical framework	Evaluation and testing of solutions in practice	Documentation and reflection to produce "design principles"
Analysis	SME & LD explore a significant problem Literature review, web search and discussion to find out how others approach the problem Needs assessment and analysis			The LD and SME create draft principles from sources to guide the design of the learning environment.
Design		Using appropriate theoretical principles and information derived from analysis, LD and SME prepare learning design		The LD and SME document their rationales and reasons for design decisions and models/ strategies/innovations used
Development		Development of learning environment (often involving team of experts and technology) with formative evaluation during development		Draft principles, and information on the design and development of the learning environment are presented at a conference
Implementation			The SME implements the learning environment	
Evaluation	The LD and SME share and discuss the design principles with other practitioners with the aim of reflecting, challenging, affirming, applying or extending them	The LD and SME share and discuss the design model with other practitioners with the aim of reflecting, challenging, affirming, applying or extending them	The SME and LD collect data on the effective implementation of the learning environment	Using all evaluation data, principles are refined and published in a journal for dissemination to the HE community
Evaluation functions *	Review Needs Analysis	Formative	Effectiveness	

*Impact and maintenance evaluations are conducted only after a learning system has been operating as intended for a year or more.

Figure 1: Extending the role of the learning designer through design-based research

The table shows that the stages of design-based research can prompt the natural products of a learning design collaboration between SME and LD to be shared and distributed. The design and proposal stage can readily form the basis of a short or brief paper at conferences such as ascilite or other professionally-oriented conferences, and valuable feedback and advice can inform and improve the design. After implementation, the evaluated learning environment, together with the design principles, can be described and published in a refereed journal. In so doing, the scholarship of teaching and learning developed in the learning design process is not lost to the profession as a whole.

Conclusion

The framework proposed in this paper articulates an approach that extends the role of the learning designer to encompass evaluation and design-based research, in collaboration with the subject matter expert. Our intention is to further develop and describe these principles for future practices in educational development. A design-based study will be undertaken to determine the applicability of this process for the field of learning design. The expected benefits are twofold – firstly, to report and describe practical insights associated with this approach; and, secondly, to present our findings on the implementation and evaluation of an authentic learning design. The value of this approach is that it is focussed on designs and processes that respond to the local context; it is grounded in theory and yields knowledge or guidelines that can be shared and used by others to improve educational practice – demonstrating a commitment to theory constructions and explanations while solving real-world problems.

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Integrating culture in the second language curriculum through a three-dimensional virtual reality environment

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Networked computer technologies have a strong potential for enhancing second language (L2) learning in the modern classroom. Three-Dimensional Virtual Reality Environments (3D VREs), in particular, provide features to support student motivation, socialization and interaction. These include, for example, the ability for L2 learners to present as avatars, build virtual structures and interact with others in conversational modes. In this preliminary qualitative case study, we examine the perception of culture through online exchanges between both Japanese and English learners within the Virtual Babel project. Critical reflections and an agenda for further research conclude our paper.

Keywords: culture and technology, teaching and learning strategies, learning communities

Introduction

Despite a historical emphasis on grammar and accuracy in second language (L2) curriculum, communicative language teaching approaches in the late 1970s fuelled a strong interest in the dialectical relationship between L2 teaching and target culture teaching (e.g., Byram, 1997; Byram & Risager, 1999; Kramsch, 1998; Pulverness, 2003). Nowadays, without the study of culture, L2 teaching is seen as inaccurate and incomplete (Genc & Bada, 2005).

National Standards for Foreign Language Learning (1999) developed in the United States revamped L2 teaching through the establishment of a series of '5C' targets: Communication, Culture, Connections and Comparison, and Communities. Importantly, the 5C targets have been widely adopted and are used to form the basis of integrating culture into a computer-based L2 curriculum (Champion & Sekiguchi, 2005). In this study, we explore student perceptions of culture amongst 5C targets during a Japanese-English exchange project within a three-dimensional virtual reality environment (3D VRE).

The international collaborative project

We built the web-based 3D Virtual Reality Environment (VRE) using *Adobe® Atmosphere®* so that student avatars could communicate through text-based chat. Language learners from Australian and Japanese universities participated. In Australia, 16 upper-intermediate students learning Japanese joined the project; from Japan, 36 students learning English participated.

Project task

In effective L2 environments, task design is paramount (Bygate, Skehan & Swain, 2001; Farmer & Gruba, 2006). In this project, students worked in cross-institutional teams to construct virtual environments regarding entertainment, travel, contemporary society or education. For those interested in Japanese movie directors, for example, they built a cinema that was able to show visual images. Others interested in discussing relationships, for example, a furnished lounge that featured music equipment, pictures, posters and lighting. Student groups met in class once a week for one hour for three months. They were also encouraged to spend time working on their 3D VRE outside of class. To motivate efforts, staff and students voted on an award for the best venue at regular intervals.

Data collection

From November 2005 to January 2006, data was collected from two introductory technical sessions and ten 60-minute interactive sessions through 80 chat log sessions. Participants also submitted approximately 170 reflective journal entries that described activities and task progress. In addition, screenshots of VRE progress was kept. Sekiguchi maintained an instructor's reflective journal after each session.

Data analysis

In line with qualitative data methodologists (e.g., Miles & Huberman, 1994; Richards, 2005), we coded data based on the 5C framework. After several review cycles, we chose to focus on three Australian student reflective diary entries to provide a preliminary view of how students perceived the 3D VRE intercultural learning activities. We selected Cliff, Ken and Lilly to represent the overall Australian participant group because these three varied widely in L2 proficiency, gender and motivation.

Results

How do students perceive various aspects of the 5C framework? In Table 1, we calculated percentages of coded representative student journal entries to show the relative perceptions in areas of the framework.

Table 1: Representative student perceptions of 5C curriculum areas

	C5 standards sub categories	Cliff	Ken	Lilly
1.	**Communication:** Communicate in the language			
1.1	Engage in conversations, provide and obtain information, express feelings and emotions, and exchange opinions	20%	29%	21%
1.2	Understand and interpret written and spoken language on a variety of topics	16%	15%	11%
1.3	Present information, concepts, and ideas to an audience of listeners or readers on a variety of topics	16%	17%	13%
2.	**Cultures:** Gain knowledge and understanding of the culture			
2.1	Demonstrate an understanding of the relationship between the practices and perspectives of the culture	2%	13%	6%
2.2	Demonstrate an understanding of the relationship between the products and the perspectives of the culture	2%	10%	6%
3.	**Connections:** Connect with other disciplines and acquire information			
3.1	Reinforce and further their knowledge of other disciplines through the language	0%	0%	7%
3.2	Acquire information and recognize the distinctive viewpoints that are only available through Japanese language and culture	0%	2%	3%
4.	**Comparisons:** Develop insight into the nature of language and culture			
4.1	Demonstrate understanding of the nature of language through comparison of the language and their own	0%	0%	0%
4.2	Demonstrate understanding of the concept of culture through comparisons of the culture and their own	0%	4%	6%
5.	**Communities:** Participate in multilingual communities at home and around the world			
5.1	Use the language both within and beyond the school setting	25%	6%	14%
5.2	Show evidence of becoming life-long learners by using the language for personal enjoyment and enrichment	20%	4%	13%

Surprisingly, we found that few student comments related specifically to the notion of 'cultures' (Category 2). Both 'communication' (51%) and 'communities' (28%) figured more prominently. To make sense of this, we speculate that strong references to literature, traditions, and art work make the concept less dynamic and less interactive (known as 'Big C' cultural instruction). Students likely experienced 'culture' through weekly exchanges and interactions between members of differing nationalities (known as 'Little C' cultural instruction) and thus see it as part of effective communication.

Standard 1: Communication

By far, diary entries of representative Australian students focused on how well they communicated with Japanese students. This strong awareness of communication, we think, is the result of both the novelty of the 3D VRE and a desire to test its capabilities. As Cliff notes, many students had lots of "curiosity about the virtual world and what you could do with it." Students tested again and again their ability to 'replace' or even 'create' effective interpersonal communication styles in the new environment. Did strategies effective in the carbon world transfer to the digital one?

Lilly observed that dynamic cultural learning came through exchanges about things that "cannot be found in books" including new words, concepts and personal observations. Interpretive communication, or making sense of the language in use, became a hallmark of the project. Instructors often saw students push beyond traditional classroom boundaries as they became 'cultural facilitators' between groups.

Presentational communication, learning to speak to many at a time, came alive through negotiations about how to create and decorate the virtual rooms. Ken reflected on how the changes in a room would lead to surprises that in turn would motivate full participation. Presenters, of course, need audiences and must learn to accept and give praise and criticism after concepts are put forward.

Standard 2: Cultures

Differences between the 'practices' and 'products' of culture were difficult for us to code. Throughout the data set, the specific term 'culture' did not appear often – for students, perhaps, the concept of culture rests primarily in 'Big C' areas such as literature, music and traditions. An entry from Ken pointed to a traditional view of Japanese arranged marriages. Lilly noted how direct communication with Japanese differed from what she had learned about their culture in textbooks.

Standard 3: Connections

Prior to coding, we thought students using the 3D VRE would make a lot of 'connections' beyond those made in a traditional L2 classroom. However, we found few clear examples. Perhaps, as Lilly pointed, students stayed on task and only occasionally 'drifted off the topic' and thus did not initiate a great deal of sharing of new information. Though we thought task of constructing a theme-based room was relatively unstructured, perhaps the design itself constrained the students' willingness to connect with each other.

Standard 4: Comparisons

Comparisons between Australia and Japan did not dominate the student discourse. Differences in L2 abilities, however, came to the fore. Japanese students were better in English than Australian students were in Japanese, but both sides were limited in their L2 proficiency. Importantly, students modified their native language discourse to communicate. For some, this was a first meeting with non-native speaker.

Standard 5: Communities

A sense of community pervaded the data set. Students often reflected about the collaborative efforts required to build a space in the 3D VRE. Unlike traditional L2 lessons, they were actively engaged in a self-directed activity with native speakers. Cliff notes that they 'built something they could actually use' through the use of language and technology. Here, language itself was instrumental in the creation of a special 'reality'. Perhaps partially motivated by the novelty of working within the 3D VRE environment, the sense of co-constructing a theme-based room helped students feel part of a learning community.

Discussion

Learners showed an awareness of their L2 development as well as an awareness of improved intercultural communication strategies. Students demonstrated efficacy in re-phrasing and adjusting for their counterparts. They were able to utilize multiple strategies to communicate; importantly, their messages were richer, more honest and multi-layered. Throughout the activities, they discussed with a sense of purpose and immediacy. The 3D VRE was novel and provided motivation to work outside set hours.

Task design was successful, and we were pleased to see that students made their own decisions in building virtual spaces. Notably, the purposely ill-defined task caused students to manage conflict, make group decisions and meet imposed deadlines. Here, intercultural training took place through working in small groups on a common project. Students indeed created community that sparked active participation. Nonetheless, despite being ill-defined, the task appeared to constrain the students – that is, 'construction' in the 3D VRE limited their freedom to explore new topics, make connections and know each other. Future work could examine how task design affects performances in this interactive environment.

Suggestions for further research

Here, we have relied on only three Australian students' perceptions of 5C curriculum. We are keen to analyse much more data from a larger variety of sources and participants. Comparisons across the Australian and Japanese learners may be fruitful, specifically in the areas of cooperation and negotiation.

Mostly, however, we are set now to examine how participation in the Virtual Babel project influences the way learners make use of the L2 in a social context, that is, how language socialization develops in a virtual environment. As Duff (2003) notes, there is little research on how L2 socialization occurs in computer-based learning environments. Further, we need more research regarding how learners work with authentic social discourse within a community of practice (Lave & Wagner, 1991). A longitudinal investigation may show how L2 learning in a 3D VRE can transfer to practices in everyday situations.

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Why don't students attend lectures and what can be done about it through using iPod nanos?

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How can teachers encourage students to listen in lectures – and indeed to attend them? What about international students and those who have language difficulties? These were the questions which triggered a study of the beliefs of first year students about learning from lectures, and a desire to improve students' ability to learn from lectures through providing MP3 uploads and a classroom set of iPod nanos. Students completed a pre- and post-course evaluation which revealed their beliefs about lecture attendance and supplementing that attendance by listening to lectures on iPods for revision and re-listening.

Keywords: contemporary challenges, personalised learning, iPods, audio streaming, educational evaluation, mLearning, teaching and learning strategies

Introduction

Often lecturers observe a gradual slide to lecture non-attendance by undergraduate students as the academic year unfolds and their good intentions regarding lecture attendance (Crisp 2006) are undermined by their busy lives (Krause, Hartley, James & McInnis, 2005), or possibly what they see as a marginally useful learning environment (Wood & Burke de Silva, 2006). Non-attendance may disadvantage those students as well as depress lecturers who have prepared an engaging and interactive session (Wood & Burke de Silva, 2006). Despite the ability to upload lecture notes and PowerPoints from course websites (LMS) for anywhere, anytime retrieval, this "self-lecture" is not the same as hearing the lecturer deliver the lecture with the vocal emphases therein (synchronising audio and Powerpoint is not easy.) In 2006, in light of Australian evidence about pressure on first year students (Krause et al., 2005) I realistically abandoned the expectation that students would necessarily attend all lectures, and made robust provision for those who did not attend (even in a poorly resourced school where technology was not in place for audio or video lecture streaming). This paper presents an educational evaluation which uncovers students' reasons for non-attendance at lectures, and evaluation results which show that students believe it is important to attend lectures (87.5%) and even more important (92.5%) to get the information from lectures (whether they attend them or not).

Mellow (2005) asserts that in educating the mobile net generation (born after 1982), the so called "Gen Y", "institutions should consider some form of mobile delivery to attend to new students" – "mLearning". Duke University selected iPods to deliver content to all first year students in 2004 (Duke, 2004 in Mellow, 2005) as did Drexel University in 2005 (Perlman, 2005 in Mellow, 2005). The pilot study at the University of Adelaide built on these initiatives whilst mindful that "mLearning" is a subset of all learning within a blended learning environment, and is a means to enhance the broader learning experience – not a primary means to deliver courses. It is a powerful method for engaging learners on their own terms – especially "for those groups of learners who cannot participate in classroom learning for whatever reason" (Valentine, 2004 in Mellow, 2005).

Students in a Semester 1, Year 1 compulsory 6 unit bearing course "Human Environments" were the subjects for this study. There were two lectures per week and four hours of scheduled Workshops (2) and Tutorials (2). The face-to-face lectures were audio taped and uploaded to the course website (LMS) for audio streaming as well as converted to MP3 files for uploading to MP3 players. A class set of iPod nanos was purchased and made available for free loan which 24 students availed themselves of (23%). Many students in the class already possessed an MP3 player (25) or an iPod (19) so there was reasonable penetration of 69% of the class having MP3 playing equipment. Students were able to access the twice-weekly lectures in an online environment within a day (audio files) to a week of delivery (for MP3 files).

The research questions concerned students' use of the audio streaming and MP3 facilities to listen to lectures and their beliefs about the importance of attending lectures and the reasons for non-attendance. The pilot "nano" project was to be evaluated in terms of value adding to students' learning outcomes – judged by did they use this technology? And did they see a benefit in the provision of the technology to them?

Method

During Orientation Week, prior to the commencement of semester, students were asked to complete an anonymous online Design Studies questionnaire that posed questions about students' familiarity with IT and the online design environment. A response rate of 68% (71/105) was achieved. They also answered an anonymous university-wide questionnaire about their expectations of university (Crisp, 2006).

At the end of Semester students were asked to complete an anonymous paper-based SELT questionnaire. Questions were posed about students' satisfaction with the course and their attitudes to learning in the course. A response rate of 81% (85/105) was achieved, which is generalisable. The anonymous open-ended responses were coded and analysed by the researcher. Codes are available on request. A head count was conducted each week in lectures with attendance ranging from 40% to near 100%.

Results

Table 1: Commencing student details, familiarity with computers & the online environment

Question	*Overall Response Rate 71/105 = 68%*		
Are you a school leaver? Y/N	Count 69 45 Yes	24 No	
How old are you? Age	Count 70 Average age 19.3*		
What sex are you? M/F	Male 40	Female 31	
What internet connection do you have at your term-time residence? None, Dial-up modem, Broadband	Internet Connection 64 / 71 respondents None 7 Dial Up 23 Broadband 41		
Do you have iPod, Other MP3 player, Both, Neither?	iPod 19 Other MP3 25	Both 4 Neither 23	
	Mean 7 point Likert scale where 1= never used it and 7 = thoroughly familiar	No and % of respondents who scored 5–7 on Likert scale	No and % of respondents who scored 2–7 on Likert scale [showing some familiarity]
How familiar are you with using a PC (personal computer)?	4.8	48/71 (68%)	71/71 (100%)
How much experience do you have with electronic mail (e-mail)?	5.1	56/70 (80%)	70/70 (100%)
How familiar are you with the World Wide Web as a USER (browsing)?	5.7	57/71 (80%)	71/71 100(%)
How familiar are you with the World Wide Web as a web site creator?	1.2	5/71 (7%)	21/71 (30%)
How much experience do you have with internet messaging (e.g. MSN)?	4.6	48/71 (68%)	66/71 (93%)
How much experience do you have with pod-casting?	0.6	2/71 (3%)	8/71 (11%)

Note. * excludes one 49 year old.

Students commencing the course reported overall familiarity with computers and the online environment. Surprisingly for the "net generation" they are inexperienced with pod-casting, despite 44 students already owning MP3 players. Students' end of semester evaluations (Table 2) reveal that students are satisfied with their course (92%) and 96% report their ability to work independently being increased whilst 99% of respondents agreed that they understood the concepts presented in the course. However 19% report motivation difficulties.

Table 2: Students' post-course evaluation SELT

Question Overall Response rate 85/105 = 81%	**Mean** 7 point Likert scale: 1= strongly disagree; 7 = strongly agree	**No and %** of respondents who scored 5-7 on Likert scale
Overall I am satisfied with the quality of this course	5.7	78 (92%)
The course stimulates my enthusiasm for further learning	5.8	76 (89%)
It is made clear what is expected of me	5.6	74 (87%)
I am motivated to learn in this course	5.4	69 (81%)
This course helps me to develop my thinking skills	5.7	76 (89%)
My ability to work independently is being increased	5.9	80 (96%)
I understand the concepts presented in this course	5.9	79 (99%)
I attended all the lectures in the course	5.7	64 (80%)*
I believe attending lectures is important	5.9	70 (87.5%)
I believe getting the information from lectures is important (whether you attend them or not)	6.1	74 (92.5%)
I listened to the lectures online with audio streaming	3.5	24 (33%)
I listened to the lectures online with MP3 podcasts	3.2	21 (29%)

Note. *See text below for explanation.

Triangulation of data reveals that 60% of students (63/105) did not attend all lectures (43/105 responded to the question "If you missed any lectures, why was that?" with reasons for non-attendance and 20 were absent on the day of the survey). However 87.5% of students believe attending lectures is important and 92.5% believe getting the information from lectures is important (whether you attend them or not).

Discussion

Forty three reasons given in the open-ended responses for lecture non-attendance ranged from family and personal issues (mentioned by 22 respondents) including illness (14) to the next most prevalent reason university workload (7). Five students mentioned lack of motivation and paid employment was also mentioned five times. Timetabling was mentioned three times and time management twice. Only twice was the ability to listen online to lectures mentioned at the same time as lack of attendance, but on both occasions students said they would have missed the lectures anyway regardless of alternative means for lecture access due to paid employment and travel difficulties.

The provision of an alternative means for "getting the information from lectures" is seen as important to lecturer and students. Twenty nine percent listened to pod-casts and 33% listened to lectures with audio streaming.

Students were then asked "Do you think there are benefits to you of having lectures audio streamed and available as MP3 uploads?" to which 71 students responded. Twenty students simply answered "Yes", whilst 21 students said that the pod-casts and audio streaming were an adjunct to attending lectures: "Yes, in the case of students missing lectures or wanting to revise for the end of Semester by listening to lectures". Twelve students remarked about the reflection/revision/re-listening opportunities provided for their learning: "Yes. Sometimes we may miss some points in the lectures and the lectures audio streamed and available as MP3 downloads let me re-listen and jot down the notes fully." Three students who said that they did not use them nevertheless thought that they were beneficial: "I don't personally listen to them but I think other students may find them beneficial and it's good to have them there just in case". Two students mentioned anywhere/anytime learning "Yes, we can rethink the lecture usually while on the bus etc when you wouldn't normally be concentrating on anything" and two that there were benefits for international students: "Also international students can taken their time with it in case they don't understand it the first time". Other points made were that video streaming is preferable to audio streaming (2) although Wood & Burke de Silva (2006) found that this led to major reduction in lecture attendance; that listening to lectures is easier to follow than viewing PowerPoint slides (1) and that problems with technology prevented the students from uploading the files (2). Importantly only one student reported that "it encourages students not to attend the lectures". Students were then asked for which activities they used the School's borrowed nanos. Responses revealed that students combined recreational usage – listening to music (10) – and listening to lectures (12) with file storage and transfer.

Conclusion

Students in this course received good grades with 2 High Distinctions, 30 Distinctions, 36 Credits and 24 Passes, despite 60% of students not attending all lectures, as a result of family, personal and other issues (including illness). Ninety two percent were satisfied with the course with 99% believing that they understood the concepts presented. Students remained engaged and enrolled, with only 9% not completing the course. Any opportunity to reinforce learning is seen as positive to the students with 89% of students declaring that there were benefits to them of having the lectures audio streamed and available as MP3 pod-casts, in particular as an adjunct to lecture attendance and for revision and re-listening.

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Bionotes

Dr Susan Shannon, of the School of Architecture, Landscape Architecture and Urban Design, The University of Adelaide, is an architect who is passionately interested in student learning, and how best to facilitate active learning outcomes, particularly for school leavers.

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Implementing e-learning across a faculty: Factors that encourage uptake

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The development of e-learning resources, the educational design and outcomes of their application dominate the e-learning literature. Less often considered, but equally significant, is the manner in which these resources are implemented and integrated into existing curricula and teaching contexts to promote sustainable use as well as high quality student learning experience. We describe our experience of the implementation of e-learning platforms utilising a centrally supported learner management system supplemented by Faculty developed innovative e-learning tools designed to stimulate learning through inquiry. The Faculty's implementation strategy focussed on incorporation of e-learning activity across the curriculum to enhance the existing on-campus experience. Shared leadership promoted innovation and encouraged staff to utilise e-learning approaches tailored for their teaching context that were authentic and constructively aligned to the graduate attributes, and to share their learning from these experiences. Significant aspects of the success of this strategy included the provision of high quality educational design, empowerment of staff to experiment, timely staff development, focus on the relationship of the specific learning outcomes to the graduate attributes, development of customised flexible and easy to use resource development platforms and a strong focus on student learning experience monitored by reflection and research.

Keywords: organisational change, infrastructure and management, ICT policies and strategies

Introduction

The use of e-learning activities or 'e-tivities' (Salmon, 2002) in higher education is now considered by students as a normal and essential part of their student learning experience. The manner and degree of success of e-learning incorporation into existing degree programs is variable within and between institutions as is the impact of e-learning on student learning experience. While students expect high quality online learning resources and activities and a greater flexibility in learning, there are also financial and resource constraints which impact on the uptake and integration of e-learning platforms. In contrast to the demand for greater flexibility, many student cohorts, such as those in the Faculty of Veterinary Science (FVS) at the University of Sydney (USyd), value the on-campus experience and the face-to-face interaction with academic staff and view substitution of these learning contexts with e-learning activity with suspicion, particularly fee paying students who may value interaction with academic staff more highly than other learning situations. As well as considering student perceptions of the quality of the learning experience, academic staff must balance the impact of e-learning activity development and its application with their workload and capability with educational technology. Consequently, some staff, particularly the "late adopters", need encouragement and targeted staff development to engage with the quality teaching opportunities that e-learning offers. A coherent faculty strategy for e-learning that provides the necessary resources can make a crucial difference by providing a context for e-learning that supports successful, sustained integration in the curriculum (Phillips, 2005).

The FVS embarked on a coordinated program of implementation of innovative blended delivery of e-learning resources in 2003, following three years of intensive curriculum innovation and cultural change. The FVS is a small professional faculty within a large research-intensive University and has achieved significant and sustained uptake of e-learning across the curriculum which students value highly as a contributor to their learning experience (discussed below). FVS encouraged innovation, and its 'post innovation' implementation strategy has seen the return of e-learning resource development back to academic staff, who require only a modest level of technological capability to develop their own resources. The Faculty has focussed on learning first, avoided a preoccupation with the technology, and empowered staff to pursue the full range of implementation possibilities, from supplementary to integral use of e-learning, in their units of study. This approach supports our philosophy in which the pedagogy of the learning activity is paramount and the technology used to achieve these outcomes is incidental.

Background on level of e-learning uptake in the FVS prior to 2002

The FVS is a small faculty of approximately 80 academics on two sites with approximately 800 full time students enrolled in two undergraduate degrees (5 year BVSc and the new 4 year BAnVetSc) and a range of postgraduate course work and research degrees. Prior to 2000, computer assisted learning was used sporadically as a supplement for several units of study, primarily supplying content (on line notes), customised case studies on CD Rom, simulations, laboratory exercises (CD Rom) and formative self assessment (multiple choice questions). A small group of "early adopters" had invested substantial time in creating two important online learning resources: OLIVER (the Online Library of Veterinary Images for Education and Research), which is an indexed collection of veterinary images, and the library sponsored VEIN (Veterinary Education and Information Network), a portal for accessing a range of web and library based resources and readings for units of study.

While students were enthusiastic in their utilisation of the educational technology, few staff used e-resources or e-activities in a systematic way to support the core face-to-face teaching in lectures and practical classes. E-learning was considered to be an optional 'add on': it was at the discretion of staff to use if they wished but was not governed by a strategic plan for its utilisation or support. Between 2000 and 2002 the FVS introduced a new curriculum for the BVSc degree which was designed to develop graduate attributes (including those in information literacy) (Collins & Taylor, 2002). It incorporated a lecture-free final year of clinical practice; much conducted off campus, and was combined with a rapid doubling of student numbers (increase in fee paying students). At the same time the Faculty was led through substantial structural and cultural change by a new Dean (Canfield & Taylor, 2005). Faculty leaders developed a FVS vision of shared leadership to achieve excellence in student centred learning and innovation. An aligned teaching and learning plan was developed to achieve this vision and Faculty commenced intensive staff development in shared leadership and student centred teaching and learning, which helped to create a climate that made change possible. These developments were set within a changing university context that saw implementation of evaluation and quality assurance of teaching and learning, coupled with rewards for excellence, innovation and scholarship in teaching and learning (Barrie et al., 2005).

Strategies, policies and initiatives that changed staff participation and uptake of e-learning and its use across the curriculum

A change in the context for teaching and learning has been a major factor driving increasing e-learning uptake in the FVS. While e-learning platforms and support were available prior to 2003, their uptake was fragmented. A shift in attitude occurred in the FVS from the view that e-learning was a desirable, but not essential addition to classroom teaching, to the current situation where blended and fully flexible learning are major aspects of the curriculum and involve most teaching staff. The FVS policies designed to support quality and innovation in teaching were a critical factor influencing staff responses to the possibilities that e-learning offered. The Faculty developed a coherent and harmonised strategy to encourage and support faculty-wide uptake of e-learning, following Ramsden's recommendations for improving the context for quality teaching (Ramsden, 2003). The key aspects of this change were: articulation of a vision of the FVS as a leading innovator in veterinary education; development and implementation of the FVS teaching and learning plans and key indicators for e-learning; appointment of staff to lead and support e-learning implementation; allocation of resources to upgrade e-learning classrooms; recruitment influenced by e-teaching potential; provision of competitive funds to support teaching innovation projects; training and development of staff in groups and individual coaching; establishment of an e-learning development and research group; and recognition of e-learning workload and achievements.

Since 2005 FVS initiatives have been complemented by USyd strategies which provide e-learning support through the Flexible Online Learning Team (FOLT, described in Wozniak et al., 2005). This support is directed at management of the WebCT learner management system and at strategic development. The FVS has also built e-learning resources and platforms to augment the WebCT LMS tools, including an image repository (OLIVER) and information gateway and learning object repository

(VEIN) and tools for the development of case-based e-learning activities (CaseBuilder) (described in detail in Canfield & Taylor, 2005 and Sheehy et al., 2006). The implementation of e-learning platforms across the Faculty was conducted in a strategic manner, with acknowledgment of the impact on academic workload and emphasis on sustainability of application and innovation. Staff and student perceptions of the value of e-learning were addressed through reflection and research to promote uptake and an enhanced learning experience. A central issue for the Faculty, when planning a substantial and widespread increase in e-learning, was to identify where and how online resources or activities might best enhance existing student learning tasks. A teaching innovations project team was established and operated, based on the principles of shared leadership developed through the Faculty staff development program. The project received support from the FVS, physical space and external funding; their first task was to identify goals for improving learning across the curriculum. The team developed an embracing theme for the teaching innovation project: "Learning through Inquiry". This incorporated existing teaching innovations (e.g. adaptation of face-to-face activities as described by Krockenberger and Canfield, 2002) and sought to develop software systems to make it easy for staff to adopt these models for online learning. An early decision was taken to use the funds to recruit expertise in e-learning design, to purchase equipment to enable all students to have access to the online resources, and to expand the existing OLIVER and VEIN resources (Canfield & Taylor, 2005). Faculty-wide debate ensued, followed by a process of project submissions, peer review and selection. Academic time and general staff support for development of e-activities and resources was obtained from FVS executive, through inclusion of a time allocation in the academic workload model that the Faculty developed. Staff with supported projects were accountable for researching, reporting and disseminating the outcomes of their innovations, and assisting their peers to adopt well-tested models of good practice.

High quality educational design to support implementation of e-learning

Student perceptions of their learning experience were a central consideration in planning the implementation of e-learning. FVS sought to use e-learning activities and e-resources in a strategic way to improve student on campus learning experience. Student perceptions of the benefits of e-learning activity are related to their perceptions of relevance and alignment to the learning outcomes that will be summatively assessed in the unit of study (Marcus et al, 2004). In planning the educational design, focus should be on the appropriateness of the learning activity, its relationship to assessment, and how the online activity supports student achievement, therefore applying the principles of constructive alignment (Biggs, 2003). To guide and ensure effective design, and avoid the risk of becoming distracted by the technology itself, the Faculty employed an educational designer in 2003. The availability of this expertise, embedded in the Faculty, was a turning point in reaching and engaging the middle and late adopters to experiment in using e-learning. At this time a series of FVS workshops was provided to generate discussion about different ways to offer e-activities, many staff attended USyd-offered WebCT workshops to develop skills, the Library personnel trained staff in OLIVER and VEIN use and key staff were funded to attend formal training in e-learning design. The in-house assistance of an e-learning designer, along with project supervision by the Faculty's teaching innovation team, helped ensure new e-learning activities were directly linked to learning outcomes of units and, in many instances, incorporated as a component of assessment. Table 1 highlights the percentage of units of study which develop graduate attributes in information literacy through e-learning (Faculty of Veterinary Science, 2006a) and the number of units of study that incorporate some e-learning activity as a component of assessment (summative or formative).

Table 1: Percentage of units of study that develop information literacy attributes and utilise e-assessment

Year of BVSc curriculum	Percentage of units that utilise e-assessment	Units that don't focus on developing information literacy skills*	Units with minor focus on information literacy attributes*	Units with major focus on information literacy attributes*
1	87%	0%	14%	86%
2	62%	14%	43%	43%
3	78%	0%	20%	80%
4	67%	11%	44%	44%

Note. * Source of data: Faculty of Veterinary Science (2006b)

The integration of e-learning activity into a predominantly face-to-face learning context, described as a 'blended delivery' approach, has also been an important driver in student acceptance and at no stage has e-learning been substituted to save on teaching costs. Student acceptance of this approach has been high: 'The mixture of lectures as well as small group tutorials and practical classes as well as online learning ensured that students were learning the same topic from a different angle', 'I think that it is good that they are doing lots of online cases and other online components to complement learning'. The maintenance of staff contact and on-campus timetabled e-learning activity has allowed for an easy transition to an online supported curriculum. Importantly, the Faculty spends very little time training students in use of the LMS or other e-learning platforms as students now display a high level of technical literacy and most platforms (particularly the Faculty designed interfaces) are intuitive. A general introduction into the use of WebCT is provided in Year 1 and various units of study introduce other software interfaces as they are encountered in the curriculum; online or telephone help is available.

Influencing and empowering staff to adopt e-learning

The FVS has maintained a clear focus on the question, "Why use e-learning?" to ensure it is appropriate and effective for our curriculum. Teaching staff understand that the relevance of learning outcomes and alignment with assessment are key factors for student engagement online as well as in traditional classes; so careful, strategic selection and use of e-learning activities is essential. Of course producing and maintaining more sophisticated online materials and activities, carefully tailored to meet student learning needs, has great potential to increase the academic workload, particularly as they become widely used (Table 2). The Faculty have undertaken to limit the impact on workload by acknowledging the way in which academic staff develop resources and by providing tools to enable staff to adapt content to an online format while requiring only a low level of technical competence. These initiatives have included providing educational design and administrative support for e-learning innovation and LMS site maintenance, promoting University administered e-learning training opportunities and developing e-learning resource development platforms that are easy to use and well supported. Another approach to promoting sustainable e-learning use and innovation by academic staff has relied on modifying staff perceptions of the benefit of e-learning to the learning experience. The incorporation of an e-learning question to the Unit of Study Evaluation process in 2004 personalised the accountability for e-learning to unit of study coordinators and provided student feedback on e-learning in each unit of study, which is openly available in FVS (Table 3). The profile and significance of e-learning to the academic workload is highlighted by its inclusion in new staff contracts of employment, signalling that e-learning activity is an expectation of an academic position along with traditional teaching and research activity.

The change in e-learning culture has been supported by acknowledging and rebutting common negative views, including the long held misconception that e-learning will decrease academic workload or render staff redundant. This has not been in evidence in FVS, but the equally erroneous conclusion that it will result in additional workload (beyond the development phase) has also not been confirmed by experience. Consistent with Applebee et al. (2005) FVS staff identify significant pressures and limited time to devote to developing their capabilities for e-learning. While initial development may be time consuming, the application of those resources in a blended delivery model has mostly resulted in substitution of work from traditional activity (e.g. lecture, tutorial and practical classes) to online learner management (e.g. online discussion moderation or generation of formative feedback). The blended delivery model has enabled staff to engage with e-learning in a way that is comfortable without encountering the significant challenge of running a wholly online unit (Armatas et al, 2004). Additionally, staff can make small, manageable changes that create significant impacts on the student learning experience and then, through cycles of reflection and experimentation, engage more fully as their confidence and success grows. The strategies taken to broaden staff perspectives have included development of a team of staff with significant experience and a track record in innovation who provide peer support for others, the communication of the experiences of colleagues (e-learning champions) at Faculty Teaching and Learning forums and targeting individual academics for additional coaching support when undertaking new e-learning projects. While development of e-teaching skills is encouraged through University supported workshops and formal training (with high rates of FVS staff attendance) the level of technical competence has not been a significant impediment to the implementation of e-learning in the curriculum.

Staff development, funding support and new staffing supporting change

The pattern of e-learning use in the FVS has undergone further change in the past two years, from team projects to mainstream adoption. This substantial shift has occurred because the outcomes of several discrete projects that were undertaken by a core group of 8–10 participants in the teaching innovation team have now been widely disseminated and adopted in a variety of ways across the Faculty. At the same time, the core project team has continued to innovate in the pedagogy and design of the online learning activities. The e-activities have shifted in nature from short discrete case studies, designed to be undertaken independently and discussed with a group, to more complex models that stimulate student-driven choices in the learning path that is taken. These models commenced as a way to present authentic, real-world information that enabled students to engage with veterinary cases that were typical of professional practice.

The Faculty has provided continuing support for the core online education design activities; however, considerable funds have been generated to support external development and collaborative projects, as the expertise developed has been sought after by other Faculties. It has also recognised that effective, cross faculty utilisation of e-learning requires general staff support for e-learning administration and staff assistance. This acknowledges the key role of staff in implementing and sustaining e-learning in ways that are meaningful for students in their discipline, and aims to maintain that focus on teaching practice and research. Effective staff support provides a means to present mature, tested solutions with manageable risk to novice teachers so they can trust these activities in the classroom and teach with confidence rather than fear of the technology failure impairing learning. Much of the staff development is now occurring by informal, task-directed coaching, which has proved an effective approach for encouraging staff to experiment and then sustain their role as resource developers. A further incentive has been the use of University teaching innovation funds and Faculty teaching performance income for funding small teaching development projects, paying for specialist expertise in content and in design.

Creating an environment of support for leadership and change in e-learning

In order to produce successful uptake of e-learning, FVS recognised the need for effective human and technical resources to underpin our strategies for moving staff from a position of little knowledge to one of capability, confidence and leadership as e-teachers. Staff considering e-learning needed to be convinced that they wanted to use it before committing the time and effort required to make it a success. Providing just-in-time support through in-house coaching was effective, as it delivered a high level of support but enabled academic staff to gradually assume the role of e-learning developers. The leverage, where possible, of centrally provided platforms and resources was a significant strategy to ensure that Faculty resources could be directed to projects geared to meet the needs of staff. Essentially, the central services provide more generic support through a basic LMS which staff new to e-learning find cumbersome and difficult to integrate into their teaching methods for large classes. Many staff find it difficult to determine how they could best apply e-learning to their teaching context with this platform and the limited support provided. The FVS e-learning implementation strategy is specifically tailored to meet the learning, administrative and technical needs of staff to maintain a cohesive "whole of curriculum" perspective of Faculty elearning.

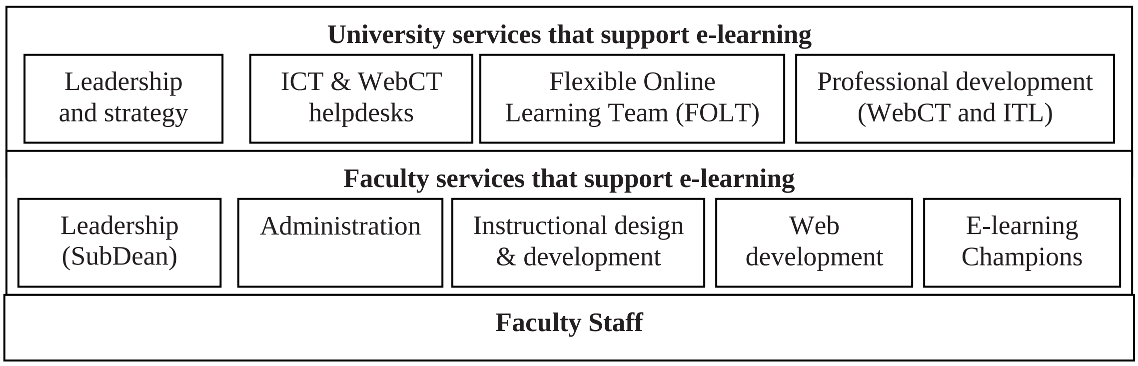

Figure 1: University and Faculty services that support e-learning

The aim of FVS support is to generate confidence in the application of e-learning to the teaching and learning process and to provide the tools to enable staff to easily create and maintain online learning resources without the need for web development skills. It was recognised that staff have priorities and expertise in their own discipline and usually are not interested in becoming experts in web development and applications. Therefore it was critical to develop ways in which tools could be provided that better align with the needs of staff and enable them to create high quality online and blended learning experiences for their learners. The tools required differed depending on the level of capability of staff and their understanding of e-learning, so it was necessary to provide tools that require a level of capability consistent with word processing applications. With a wide degree of expert and peer support within the Faculty, it was possible to support staff at whatever level of e-learning they wished to engage with. This included blended learning support, teaching and learning strategies and e-learning resource design and development. In the course of the implementation of e-learning over the past 3 years it was observed that academic staff follow a sequence of e-learning skill development and engagement as seen in Figure 2.

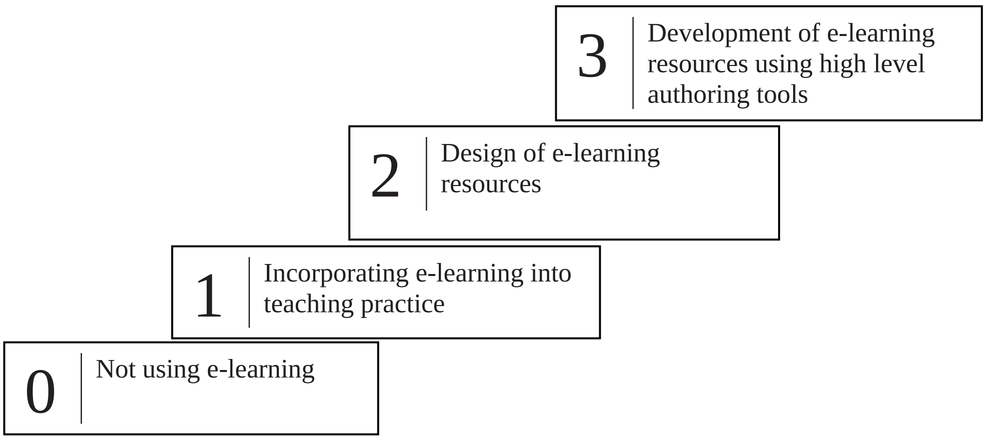

Figure 2: E-learning skill development and engagement of academic staff

At each of these steps, opportunities for research into teaching practice and support to develop capability are available. However, at levels 1, 2 and 3, there are additional opportunities for staff to make a contribution to the field teaching and learning.

Equipment to provide capability

Access to equipment that makes e-learning readily available is an obvious, but often overlooked, aspect of encouraging uptake. While acknowledging that maintaining and updating equipment in a campus with a large student body is a challenge, lack of suitable teaching facilities may be a significant disincentive to the widespread adoption of e-learning. Given the resourcing constraints as well as variations in staff capability, it is important to have access to up to date, suitable equipment that can reliably support staff in their endeavour to provide resources in an online friendly format. The Faculty invested in both equipment and staff to provide better support for teachers planning small group e-learning activities (e.g. digital projectors, computer laboratories and computer-equipped group rooms) and to support the conversion of materials to a digital format. Initially, this equipment was provided for staff to use, however, existing non -academic Faculty staff now provide high quality conversion services, although academic staff still have access to the equipment should they choose to utilise it themselves. The service model reduces workload and complexity for staff as they don’t need to learn how to use new equipment and software such as flatbed scanners and digital video editing applications. This approach has also substantially increased the rate of development and utilisation of online resources (Table 2).

Implementation and impact

E-learning uptake

The uptake of e-learning across the Faculty including the range, depth, diversity and number of e-learning resources now in use has been significant (see Table 2). The number of WebCT unit of study sites has doubled since 2002, when a policy was introduced that all units of study in the Faculty should have a WebCT presence. A large increase to almost all units in the FVS was observed in 2003, which additional unit of study sites generated each year in response to curriculum changes and the addition of specialty sites (e.g. academic honesty, year and degree administrative sites etc.). Similarly, there has been a steady increase in the contributions to the OLIVER image repository as academic staff routinely use image resources in e-activities. Further, through staff engagement with the industry, a steady contribution is being made to OLIVER by members of the veterinary science profession. The number of more complex case-based e-learning activities developed by academic staff through the 'CaseBuilder' resource development platform has more than doubled since its introduction in 2004. The success of the CaseBuilder system (and the underlying educational approach) has resulted in this model being adopted by other Faculties internal and external to the University. VEIN learning object repository visits have steadily increased and include student and general public access, as this resource is available through a public interface.

Table 2: The measures of staff uptake and student usage of e-learning resources in the Faculty of Veterinary Science

Resource	2001	2002	2003	2004	2005	2006
Units of Study with a WebCT site	13	28	45	50	52	56
OLIVER Images*	2,171	5,848	7,331	9,431	9,956	11,221
CaseBuilder Cases*	N/A	N/A	N/A	81	173	219
VEIN hits/ year	126,189	250,549	513,515	643,892	537,421	331,852‡

Note. * cumulative total; ‡ hits to 30/6/06

E-learning impact on student learning experience

More important than the uptake of e-learning is its impact on student learning experience. Table 3 shows the percentage of students over a range of units of study that responded positively to a question asking if e-learning helped them to learn effectively in their unit of study. While significant variation exists between units of study, the mean percentage of students indicating e-learning benefit has also steadily increased.

Table 3: Student perceptions from Unit of Study Evaluations (USE)†

	2003	2004	2005	2006#
Student Response (% Agree or Strongly Agree)	36%	43%	46%	48%

Note. † Question 'The online component (e.g. WebCT, VEIN and OLIVER) of this Unit enabled me to learn effectively in this Unit'; # Six months to 30/6/2006.

The data presented in Table 4 indicates that, prior to the implementation of strategies for the uptake and integration of e-learning, the FVS lagged behind other equivalent faculties in the Student Course Evaluation Questionnaire (SCEQ) student agreement that Information technology helped them learn. Following the incorporation of these approaches the mean student response was significantly altered and approximately 74% of students then agreed that "Information and Communication Technologies helped my learning". Interestingly, the mean of USE data for 2005 (Table 3) indicates that only 46% of students agreed or strongly agreed that e-learning enabled them to learn effectively compared to the 74% of respondents in the SCEQ data (Table 4) who felt that information technology helped them learn; this reflects the variation that persists in effective use of e-learning across units within the curriculum.

Table 5 shows the mean percentage of students that have responded positively to various e-learning questions in the 2005 SCEQ and includes comparable responses from the mean of all other Science faculties as well as all faculties at USyd. Each of the questions asked about a different aspect of e-learning (learning experience, resource quality, communication, integration and engagement) and for each of these aspects a greater percentage of FVS students responded favourably than those in the other Science faculties and the University mean response. Student comments include, 'Online learning experiences prompt individuals to study throughout the semester and highlight the important aspects of the subject that should be focussed on' 'I also think that WebCT has benefited my learning as it allows access to subject matter prior to being taught this material'.

Table 4: Mean percentage of students that agree or strongly agree to the SCEQ e-learning questions prior to 2005

SCEQ Question 14*	Faculty of Veterinary Science	All Science Faculties	All Faculties at USyd
2001	64%	66%	61%
2003	57%	65%	62%
2005	74%	67%	64%

Note. Q14. Where it was used, information technology helped me learn; * other questions seen in Table 5 are not in SCEQ surveys prior to 2005.

Table 5: Mean percentage of students that agree or strongly agree to the SCEQ e-learning questions in 2005

SCEQ question	Faculty of Veterinary Science	All science faculties	All faculties at the University of Sydney
Q14	74%	67%	64%
Q38	87%	76%	73%
Q41	55%	45%	45%
Q43	61%	45%	45%
Q45	59%	49%	48%

Q14. Where it was used, information technology helped me learn.
Q38. Resources on University of Sydney websites (e.g. WebCT, Blackboard, degree course sites, faculty sites, etc.) supported my learning.
Q41. Communication online with students and staff helped my learning.
Q43. The online learning experiences of my degree course were well-integrated with my face-to-face learning.
Q45. My online experiences helped me engage actively in my learning.

We used SCEQ data to map the impact of e-learning across different years of the curriculum and to identify strengths and weaknesses of e-learning in the BVSc degree program (Table 6). Years 1 and 2 have a significant level of e-learning support to learning which tapers in later clinical years where the focus is on the development of clinical and practical skills that are more appropriately supported in a face-to-face context.

Table 6: Mean percentage of students that agree or strongly agree to the SCEQ (Student Course Evaluation Questionnaire) e-learning questions in the Faculty of Veterinary Science (BVSc) 2005

Question♦	Year 1	Year 2	Year 3	Year 4	Year 5
Q14	76%	79%	71%	73%	68%
Q38	90%	97%	89%	89%	57%
Q41	63%	48%	60%	50%	40%
Q43	62%	55%	74%	57%	50%
Q45	65%	52%	62%	63%	50%

Note. ♦ Questions as defined in Table 5.

These findings demonstrate that the strategy for uptake of e-learning in the Faculty of Veterinary Science has been effective and more importantly that the e-learning activity offered to students is supporting their learning and providing an enhanced learning experience. FVS is a small faculty with a strong commitment to excellence in research and teaching so our approaches to implementation have relied heavily on creating a culture of shared leadership for education change, providing high quality education design to staff as needed, use of evidence and reflection and the alignment of activities to support the graduate attributes. It is recognized that these strategies may be more challenging to implement in larger educational units, the need for clear, well supported strategic directions, high quality support for teachers using e-learning activities, adequately equipped teaching spaces, customised easy to use platforms for developing tailored activities and a clear focus on reflection based on gathering and using feedback on the student learning experience are applicable to an enterprise wide approach to e-learning implementation.

Facing the future

The immediate future of e-learning in the FVS is growth, with expansion of the e-learning resource development tools currently in use to enhance their flexibility further in educational design and activity format. The other approach that will be of significant benefit to both our staff and students will be the establishment of an e-learning collaboration of Australian and New Zealand Veterinary Science Schools and Faculties (AVSeC) for sharing of resources and potentially cross-institutional collaboration. We hope that the same philosophies of learner-centred and teacher friendly models of e-learning resource development and application will shape the nature of this collaborative initiative.

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VEIN	Veterinary Information Education Network: A collaboration with the Usyd library, this resource aims to provide general information on a wide variety of veterinary topics as well as administrative information for learners studying at Usyd.
OLIVER	The Online Library of Images for Veterinary Education and Research is a repository of images and videos that provide staff, students and industry partners with a visual insight into veterinary science.
CaseBuilder	CaseBuilder uses a forms-based interface and requires basic computing skills to enable staff and students to easily create interactive online cases, which can contain images, videos, PDF documents and Word-based document templates.
Virtual Clinical Campus	The Virtual Clinical Campus provides online administration services to students in their lecture-free final year to enable them to easily choose placements submit assignments and receive feedback while they are off campus.
TILHAPS CAVMOLS, ICAPS	These learning resources are also designed around the same educational model which aims to engage students in authentic, real-world cases that require them to respond to tasks as required by a veterinary professional.
Anatomy online revision	This resource provides students with quizzes that help them revise their understanding of anatomy. Tags are located on high quality images and students have to identify structures, nerves and muscles that these tags are identifying.

Bionotes

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Persistent technologies: Why can't we stop lecturing online?

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There is much in the literature concerning teaching and learning online that advocates using the online environment to promote interaction and communication amongst students. Despite this much of what happens in practice in this area is focussed on preserving and translating lecture materials to the online environment. This paper explores possible historical reasons for the apparent resilience of lectures. It also examines some of the issues raised by the persistence of lectures and some possible ways to address these issues.

Keywords**:** technology change, theory in use, educational paradigms, lectures, history

Dissonance

Phillips (2005a) points out the dissonance in the design of online teaching learning environments between espoused theories and theories in use. This dissonance between the theories teachers claim to believe in and what they actually do has been noted many time in many contexts beginning with Argyris (1976). When it comes to teaching online I would like to extend the concept and suggest that the disjunct between espoused theory and theory in use is now evident across the field as a whole not just in the practice of individual academics or institutions.

An overwhelming majority of the literature in this field supports the view that that the key to effective teaching and learning online is interaction (Stephenson, 2001). Similarly a wealth of the cultural change literature in the field argues that the transition of teaching and learning to the online environment should be a transformation of existing practice rather than a mere translation (Petre et al., 2004; Fetherston, 2001). However in practice the vast majority of work going on in this field is concerned with preserving and translating existing teaching and learning formats, most notably the lecture to the online environment (Elgort, 2005; Collis et al., 2002). This focus on the lecture in effect undermines the potential for both transformation and increased interactivity in the transition to teaching and learning online.

Yet this focus on preserving and translating lectures and lecture materials has proved surprisingly resilient. It was first manifested as an approach to teaching online which consisted of posting large quantities of lecture notes on to web pages – a practice which continues despite frequent criticism. With the development of reliable streaming technologies the push has been to produce either audio or video recordings of lectures and make them available to students via the web; this has spawned an entire industry around products such as Lectopia. More recently podcasting has become the buzzword leading to a push for downloadable recordings of lectures.

This fixation with preserving the lecture format and its artefacts is doubly puzzling when you view it as a clash of technologies. Phillips (2005b) argues that there is nothing implicitly educational about the online environment, that it is merely a technology that will support various educational activities such as communication or information transmission to varying degrees. There is nothing unexpected in this claim and indeed nothing contentious, but the odd thing is the same analysis is rarely applied to the other side of the equation. There is nothing implicitly educational about lectures, they are merely a technology to support various educational activities and they are, in fact, a vastly more primitive and limited technology as they support very few educational activities beyond information transmission.

The question is why? Why are we in practice using more modern and versatile technologies to perpetuate old and limited technologies, particularly at a point when all our espoused theories would suggest that this is not a good idea? And why in the face of these espoused theories are lectures such a resilient and persistent technology? It is these questions I will make some small attempt to address in the rest of this paper.

History

As an indication of how persistent a technology lectures are, they have existed virtually unchanged for over 800 years; few technologies are able to claim a longer heritage. Exactly where and when lectures first emerge is hard to tell; they were certainly around by the 12th Century, turning up in Latin schools where they were both used and analysed under the rhetorical category *ars praedicandi* (the themed sermon), a category which reflects their religious antecedents. Not surprisingly, given the pre-eminence of theology in the early universities, they were rapidly incorporated as the technology of choice for teaching. Mallet (1924) notes that by the mid 12th Century in Oxford there were regular gatherings of clerks to hear men of learning teach. This emphasis on "hearing" learned men remained prevalent throughout the succeeding centuries. The statutes at the University of Vienna in the late 14th Century required students wishing to graduate in astronomy to "hear" the works of a number of great astronomers over the three years of their studies (Cren, 1983), likewise students of philosophy at Cambridge in the 15th Century were required to "read or hear" the works of Aristotle for a number of years before being granted their MA (Leader 1985).

Their purpose in these burgeoning educational institutions was to rapidly transmit knowledge to a large group of students in an era before the existence of the printing press and mass produced books. However, the arrival of the printing press (or any subsequent technologies) seems to have done little to diminish the importance of lectures and they have continued little changed ever since. Lectures in 14th Century Italy, with the expert at the front of an amphitheatre speaking to or at a large number of students in tiered seating, would be immediately recognisable to anyone who has studied at a modern university as would the style of lecture notes taken by students in 15th Century France (Grafton, 1981).

Over the decades (and indeed centuries) some of the subsidiary technologies associated with lectures have changed, most notably presentation tools have moved through blackboards to whiteboards to OHPs to power point slides – though all of these technologies can still be found in some modern lecture theatres. However, the key element of the talking teacher providing information in real time to groups of listening students, who then transcribe this in varying degrees of detail, is remarkably constant throughout the history of lecturing, and indeed of university teaching.

Consequences

Why has lecturing lasted unchanged for so long? More importantly, why when challenged by new technologies does it seem that lectures are winning the battle?

The first point to address is the possibility that lectures have been so persistent because they are simply the best way to do things. This assertion would be extremely difficult to support: there is ample literature casting doubts on lectures as the best way to teach at the tertiary level (Ramsden, 1992; Laurillard, 2002). There are even doubts about lectures as the best way to transmit information (Andresen, 1988). Even those who champion lectures in some circumstances admit their limitations (Bligh, 1972).

So if they are not the best way to do things why do they persist? A number of reasons are possible:

1. *Most of the people currently lecturing were lectured to as undergraduates.*
   It has only been in the last 20–30 years that attempts have been made to offer theory-based training to tertiary teachers. Previously the only real qualification for a teaching position at a university was disciplinary expertise. Consequently each new generation of university teachers replicated the teaching and learning experience they had as undergraduates, which invariably revolved around lectures. This undergraduate experience not only impacted on the practice of university teachers but also on the beliefs and values they acquired, often instilling a belief in a transmission model of teaching and learning, which promoted the view of the lecturer as the expert imparting knowledge and reinforced the role of the lecture as the appropriate vehicle to do this (Errington, 2001; Toohey, 1999).

2. *Many tertiary teachers inherit specific teaching and learning situations from their predecessors*.
   It is not uncommon for a new university teacher to start work a relatively short time before their first encounter with students and, under such circumstances, it is not surprising that they rely heavily on

the materials and teaching patterns bequeathed to them by those who have taught those units of study before.

3 *Lectures appear easy to do.*
Walking into a room and talking seems at first glance simple, certainly simpler than any of the alternatives. Notably simpler than trying to make changes to a unit of study which as mentioned previously may have well established materials and teaching patterns.

4 *Students expect lectures.*
Most of the students who enrol in universities, particularly the more traditional ones, expect that their learning experience will involve being talked at by an expert. It is a very comfortable situation, allowing students a degree of anonymity and a degree of order in their studies; it also bears some resemblance to other learning situations they may have encountered, such as school.

5 *Lectures provide a very rigid environment allowing for a high degree of teacher control.*
This can be very comforting for both teachers and students as it allows little room for surprises and gives everyone a clear role to play (Laurillard, 2002).

6 *The physical and philosophical infrastructure of the institution has been built around lectures.*
As lectures have been such an integral part of the history and evolution of universities, a number of the core structures have grown up around them. In fact they are the basic assumption underlying campus building programs in which the construction of lecture theatres is a primary concern, timetabling which divides the day into lecture slots, workload formulas based on how many lectures people teach and unit descriptions predicated on how many lectures are in the unit and when and where they occur.

All of the above are reasons for lectures to persist in the traditional university environment but don't explain the apparent resistance of lectures to new technologies. The reason for that would seem to be more subtle, but consequently more powerful: it is a semantic issue stemming from the dominant place lectures have in the discourse surrounding university teaching. All of the reasons mentioned above contribute to and reflect the centrality of lectures in the institutional discourse, but it is that centrality itself which enables lectures to persist in the face of new technologies.

Evidence of this centrality is perhaps most obvious in the title we give university teachers: they are known almost universally as *lecturers*. It is both title and job description. It is embedded in the institutional consciousness and the very self image of teachers at university that they are lecturers. They are people who lecture.

Even authors such as Laurillard whose book "Rethinking University Teaching" (Laurillard, 2002) is predicated on the idea of lectures not being a suitable teaching technology for the future, nevertheless throughout the book uses the term lecturer interchangeably with teacher.

> Working through the procedure should lead the *lecturer* to a more thorough analysis of what their teaching has to do (p.183).
>
> What we believe to be of practical help to *lecturers* depends on how we define the aims of teaching (p.11).
>
> This will be an important part of planning if *lecturers* begin to spend less time on lectures and large classes, and more time on materials development and small group mentoring (p.229).

Similarly authors such as Andresen (1988) who have questioned the validity of lecturing still position it as a form of teaching (just not necessarily the best form of teaching for all circumstances) not as a technology that may support teaching and learning.

I would argue that it is this positioning of lecturing as central to the discourse surrounding educational activities at the university, including using it as a defining element of the self image of university teachers, that makes it so persistent. The consistent alignment between lecturing and teaching in the institutional dialogue has rendered them virtually synonymous. For many practitioners embedded in this discourse, moving teaching and learning online means moving lectures online, as they are to all intents and purposes the same thing.

Ramifications

So does it matter? Is a semantic squabble over how we define lectures really that important? I would argue that it is. Our continued characterisation of lectures as teaching not technology has major ramifications for our attempts to construct effective teaching and learning environments online.

Technologies are the "how" of what we do. As long as we focus on lectures we focus on the how not the "what" and "why" of teaching and learning. Focussing on lectures drives us to attempt to create experiences online that are equal to the experience of the lecture theatre, not equivalent to it. We concentrate on reproducing an accurate reflection of individual lecture artefacts such as the voice or image of the lecturer, and accompanying overheads or slides, rather than trying to achieve the same learning outcomes. To state the obvious, a focus on outcomes would serve us much better in planning, designing and delivering effective online learning experiences than a focus on artefacts.

Furthermore, it compartmentalises and fragments the teaching and learning experience, causing us to focus on translating individual lectures into the online environment as opposed to whole programs. Lectures create the illusion of learning in manageable, discrete, self contained bundles (Baly, 1961) which can be moved one at a time to the online environment. When we have moved enough of these bundles we can claim to have moved an entire course/unit/program online but a program of study is more than just a sequence of lectures. It would be much more effective when converting to teaching and learning online to take a wholistic programmatic approach than a reductionistic lecture-by-lecture approach. However, the semantic trap of equating lectures with teaching pushes us into finding ways to record and replay individual elements of a program; rather than coherently redesign the program.

Most notably, the focus on lectures obscures the dissonance between espoused theory and theory in use. As Phillips (2005a) points out this dissonance is problematic at both an individual and systemic level, yet it persists. I would argue that one of the reasons it persists is that perceiving lectures as teaching not technology hides how big a gap exists between what we believe and what we do. If lectures are teaching, then lecturing online is teaching online, and the dissonance remains to a large extent hidden. If lectures are a technology, then we are layering one technology on another and we should ask why? At this point the dissonance becomes much harder to ignore.

Conclusion

So what can we do to overcome this? The answer is very simple to say and very difficult to do: we need to change the discourse around lecturing, teaching, and teaching and learning online. Kirkpatrick et al. (1997) when discussing the various institutional constructions of flexible learning, identifies a number of ways discourse can be influenced within universities. These include overt practices such as support systems and policy documents, but also acknowledges that there maybe institutional practices such as resource allocation, workload formulas and promotion processes whose impact on institutional discourse, though less direct, are equally important. Interestingly Cummings et al. (2005) identify a middle management strata within institutions as a crucial group to effect institutional change through "middle out" (as opposed to top down or bottom up) strategies. This group would also appear to be well placed to influence the institutional discourse as they often contribute to both the formulation and implementation of policy. This positions them to have input into both the overt statements that frame institutional discourse (such as policy documents) as well as the institutional practices that influence discourse in a more subtle but equally important fashion. If they can ensure that the message, both overt and subtle, is consistent, then the impact on the institutional discourse will be considerable.

But what should this consistent message be? Crucially we need to remind ourselves and others that when we talk about changing technologies we never start from a neutral base. Change in technologies always involves going from one technology to another. In conversations about teaching and learning online we invariably talk about the "to" – we are moving "to" the online environment, but we rarely talk about the "from". When we do, we talk about moving "from" the classroom or "from" face-to-face teaching, but these are the physical environments we are moving from; the technology we are moving from is the lecture.

The other thing we need to consider in addressing this issue is another dissonance between espoused theory and theory in practice. Our espoused position regarding cultural and technological change in university teaching is that we should focus on education and that the technology is secondary. Yet when we invoke Rogers (1995) and others like him in discussing cultural change we almost always talk about pioneers, early adopters, early and late majority etc in terms of technology uptake. Perhaps it is time to refocus our energies to promote and support pioneers and early adopters of teaching innovations, and invest as much in encouraging the early and late majority to adopt teaching innovations as we do in encouraging them to take up technological innovations. Maybe then we would see more alternative technologies to the lecture in the classroom as well as online.

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Blogging for learning: Integrating social networks for staff development

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This paper provides the background and context to a pilot study to investigate the use of blogs (personal reflections) and wikis/clogs (blogs used for collaborative reflections) to support authentic learning, communication and the development of communities of practice within a higher education environment. The study is supported by the ascilite Community Mentoring Program and the results of the investigation will be reported in full at the conference.

Keywords: staff development, blogs, clogs, authentic learning, social networks, communities of practice

Background and context

The value of community network tools to the higher education sector is gaining more and more attention (Farmer & Bartlett-Bragg, 2005). And yet some organisations are concerned at the potential loss of control from such communication environments (Sims, 2006). To better understand the value of blogs, in the context of staff development, this paper introduces an application and investigation into the use of blogging as part of a staff development programme. The blog aspect of this project was conducted as part of the ascilite community mentoring program.

This paper will describe how a blog was established and used to facilitate communication between participants of a professional development programme (http://eldss.edc.polyu.edu.hk/escholars.html). The blog was established to encourage continued dialogue between staff, from different departments across the institution, as they worked independently to redesign their own courses for blended learning.

At the Hong Kong Polytechnic University (HKPU) the 'e-Scholars Programme' was designed to guide academic staff, as a cohort, to successfully integrate online learning with the face-to-face classroom, and to expand the learning environment. The first cohort of staff began their participation in this programme in June 2006. Participants engaged in a planned course of professional development to learn about and apply the 'T5' approach to course design and delivery (Salter, Richards & Carey, 2004), while they worked on a specific course to 'rethink' their subject and incorporate blended learning approaches. The instructional design goal was to shift staff from a 'teaching paradigm' to a 'learning paradigm' in the re-design of their courses (Reigeluth, 1999).

In our approach, a 'teaching paradigm' is conceived as a learning space (classroom or online) in which an instructor's approach to course design and delivery focuses mainly on how to teach the material (transmitting information). In a 'learning paradigm' the focus shifts to an increased consideration of the students' role. In course design within a 'learning-paradigm' the question shifts from asking 'what will the instructor do to 'teach' this material?' (presentation of information), to the question 'what does a student need to do to 'learn' this material?' (promotion of critical thought). Achievement of this goal can be evaluated by looking at: a) the finished product (the course) and assessing the amount of learning tasks created as opportunities for student interaction with the course material, the instructor and with peers b) assessing the amount of actual engagement in the learning process as measured by completion of task deliverables during the course delivery and c) assessing subsequent changes in the use of class time by the incorporation of online leaning tasks.

Specifically, in the primarily lecture-based, teacher-directed instructional paradigm common in many Asian universities, the goal of the e-Scholars project was to guide teachers as they re-designed their subjects from the usual approach of simply ‘putting content online’ in the form of PowerPoints and course notes, to creating an interactive learning environment by incorporating online tasks with feedback. In addition, participants considered how the incorporation of the online component could allow changes in the use of classroom time, with a shift from lecture only to discussion and dialogue. The e-Scholars Blog is one component of the e-Scholars staff development project.

The E-Scholars blog pilot project

The primary purpose of the e-Scholars blog pilot project is to investigate the use and value of personal reflections (blogs) and collaborative reflections (wikis/clogs) in teaching and learning by incorporating the use of a blog into the e-Scholars staff development program at Hong Kong Polytechnic University. While blogs are by no means new, they remain for some institutions a form of ‘non-mainstream’ communications and therefore problematic for inclusion in formal enterprise learning management systems. In addition, many staff involved in the support of teaching and learning in higher education are unfamiliar with the creation and use of blogs. It is anticipated that the outcomes of this study will be valuable to the broad educational technology community as well as provide specific guidance for academic staff wishing to integrate blogs and clogs into their teaching and learning environments.

The e-Scholars project includes four phases: professional development, subject development, implementation and evaluation. The e-Scholars blog was introduced during the subject development phase and continued into the course implementation phase to extend the community of practice created during the e-Scholars professional development phase.

Lave and Wenger describe that a community of practice involves a set of relationships over time, organized around a particular knowledge area or activity that gives members a sense of joint enterprise and identity (Lave & Wenger, 1991; Wenger, 1999). For a community of practice to function and be sustainable, continued opportunities for sharing ideas and practices must be provided. During the e-Scholars professional development workshop, sessions were designed as coaching opportunities for participants to ‘learn by doing’ and receive feedback to their course ideas in progress; this was the beginning of set of relationships well suited to becoming a sustained community of practice. In the face-to-face coaching sessions, the coach/facilitator ensures that new ideas are fully understood so that they can be incorporated into practice. Upon completion of the face-to-face sessions, and given the beginning of working relationships formed within the group, the potential of blogs was identified as: a) a vehicle to enhance communication between participants by enabling them to continue to develop social networks outside the formal professional development setting and b) to model aspects of interactive online communications.

An e-Scholars blog was created as a vehicle to continue the community of practice within an online setting during the subject development and implementation phases of the project. One of the challenges instructors face in course redesign, is that following professional development opportunities, the expectation is for them to implement these ideas in isolation. An important part of the face-to-face coaching sessions is the dialogue between participants; this allows them to clarify misconceptions about using online technologies, describe preliminary ideas for tasks, receive feedback to help in developing these ideas and discuss best practices. The instructional designer of the e-Scholars program wanted to experiment to see if the use of a blog would provide a venue for continued dialogue. The primary goals of the e-Scholars blog are:

- to provide an easy to use online collaborative space for the e-Scholars
- to provide a venue for discussions around the ‘joys’, ‘frustrations’ and ‘philosophies’ of participants as they struggled to put ideas for course redesign in to practice
- to provide a centralized venue for participants to post their task ideas and course redesign ideas and then receive feedback from other participants (an online way to extend the face to face coaching sessions).

A secondary goal of the e-Scholars blog was to introduce staff to the notion of the use of a blog as a collaborative group tool and to model how this may be adapted for use in their own courses. The majority of the participants in this program are relatively new users of technology for learning and teaching purposes. Most have not used a blog, or developed their own blog for teaching purposes. By providing the blog as a venue for them to discuss ideas as learners, while participating in the e-Scholars program, they can learn about the tool in an authentic session. Later, during their course planning, participants may wish to incorporate a blog into their own subjects as a vehicle for students to enter reflective comments about course concepts and discuss ideas in progress with peers.

The use of the e-Scholars blog is currently in the early stages of implementation and will be evaluated over a four month period. The fourteen staff, representing six departments who participated in the first e-Scholars Program are the primary invited participants to the e-Scholars blog. During the first four months of the blogging period, eight will teach their re-designed course; six will continue with development phase for course delivery during the next term. In addition, several international guests will be invited to join to continue the dialogue and provide feedback to the staff.

Following completion of the study, and for formal presentation of the outcomes at the ascilite conference, the following factors will be addressed:

- How did participants use blogs and clogs?
- What types of issues were discussed?
- What types of questions were posed?
- Did participants provide feedback to others on their course development or implementation questions?
- Did participants find the blog easy to use?
- Did participants find the blog helpful for both the design and implementation phases of their course redesign project?
- Did participants choose to incorporate a blog as a collaborative tool in their redesigned course?

Summary

The importance of social networking tools to education is that they can be seen as an emergent form of alternative communication. Therefore it is essential that we continue to investigate and understand how new users respond to these tool sets. In addition to the research itself, the presentation will also reflect on the mentoring experience and the value of such programs to at as a catalyst to investigations that would not otherwise have been initiated.

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Student learning processes using an online PBL module in an art and design education course

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The PBL approach is used to encourage deep learning on tasks that reflect the complexity of 'real world' professional environments. Using an online learning environment as part of the PBL approach enables the students to be self-directed in their approach to problem resolution. This study considers the design of an online PBL module and how students used the online resources in their group work on a professional practice problem. Student interaction is considered from an analysis of online discussions to reveal learning processes. An end-of-course survey reveals student perceptions of this approach.

Keywords: problem-based learning, collaborative learning, online learning, online discussion, art education

Introduction

While online learning technologies are being widely adopted in tertiary education institutions, an important issue is how these can be used to enhance student learning outcomes. A way to do this may be to use online technologies to enable or support educational approaches that have been developed to foster high-level outcomes. Problem based learning (PBL) is such an approach. This approach was developed in medical schools to prepare students for the complexities of dealing with real cases, rather than text book examples with neat solutions (Boud & Feletti, 1997). Students are motivated to learn by being presented with a problem scenario that is reflective of the real world. The model requires students to be active learners, to investigate the issues and the relevant information and analytical techniques required to reach a resolution (Duch, Groh, & Allen, 2001). These characteristics of PBL make it a good approach to preparing students for a professional environment (Boud & Feletti, 1997). By using online learning technologies to enable or support PBL, with a user and activity-centred design for the online environment, the potential power of the online technologies may be leveraged further by the potential of PBL to foster high level learning outcomes.

Online support for PBL can enable students to maintain their focus on the problem task outside of class times by providing access to all course resources, and communication through online discussions. The relative effectiveness of a PBL approach has been identified as being contingent on the skill of the facilitator (Hmelo-Silver, Chernobilsky, & DaCosta, 2004; Tan, 2004). If the PBL module is online this means that aspects of facilitation need to use online discussions and other online resources to support the students as they move through the stages of resolving a PBL problem. Online discussions can be structured to encourage engagement and participation (Salmon, 2002). If this approach can enable effective student learning on a PBL problem, it may encourage a more self-directed and team-directed learning approach by students. This issue is worth investigation in relation to a PBL approach. Evidence based instructional strategies that demonstrate aspects of PBL in relation to particular types of outcomes have been identified as being a research need (Hmelo-Silver, 2004). Evidence from these strategies may enable educators to make informed choices of how to adapt the PBL approach to particular contexts. This study will consider how online support and facilitation can be used as a strategy to support student learning using PBL in an online environment.

Theoretical issues in PBL

The broad characteristics of PBL are well-known. A recent meta-analytical study suggests seven core characteristics of PBL approach:

1 Learning needs to be student-centred.
2 Learning has to occur in small student groups under the guidance of a tutor.
3 The tutor acts as a facilitator or guide.
4 Authentic problems are primarily encountered in the learning sequence before any preparation or study has occurred.
5 The problems encountered are used as a tool to achieve the required knowledge and problem-solving skills necessary to eventually solve the problem.
6 New information needs to be acquired through self-directed learning.
7 Students must learn by analysing and solving representative (i.e. authentic) problems (Dochy, Segers, Van den Bossche, & Gijbels, 2003, p. 535).

The above study identified that students developed much more effective skills from PBL approaches and that skill development is both immediate and lasting. It also found that while students may acquire less declarative knowledge than students in a comparable non-PBL class, knowledge retention is improved when learning from PBL (Dochy et al., 2003). The PBL approach is perceived to promote learning by encouraging students to actively engage in the most effective learning strategies (Biggs, 1999), and to promote the transfer of effective learning strategies to new domains (Tan, 2004).

Collaborative group work is usually considered to be an essential aspect of PBL. A meta-analysis of research on learning in small groups showed a significant positive effect on learning. This effect is enhanced when students have previous experience of learning in groups (Colbeck, Campbell, & Bjorklund, 2000). A study that considered artefacts, such as reflective writing in learning logs, produced in a PBL environment found that group artefacts reached a higher level of knowledge development compared to those of individuals working alone. While this was generally the case, group functioning did not necessarily improve performance if all the individuals in the group have a poor knowledge base (Chernobilsky, DaCosta, & Hmelo-Silver, 2004). It is clearly important for individuals to develop their own knowledge base through research and study. Group activities can provide a focus for this in a PBL environment, but are not a substitute for individual work.

The value of PBL as a structured way of facilitating the development of high levels of student capability and the experience of resolving ‘real-world’ problems make it an effective model for course development to enhance learning outcomes. The next section considers how online technologies have been used in PBL approaches to create an activity-centred design for the technology.

PBL and online technologies

When online technologies are incorporated into a PBL environment, they can perform a range of key roles, such as presenting problem scenarios in realistic ways using videos as problem starters (Keppell, 2005), providing research resources such as specialised databases (McAlpine & Clements, 2001), or supporting group work with online discussions and peer review processes. The online technologies can be tailored to support particular functions or be designed as a learning environment that supports most of the processes associated with PBL. An example is the Case Analysis In Organisational Situations program (Waters & Johnston, 2004). This enables students to work in groups to consider problems in Organisational Behaviour. The approach used presents a problem and asks students to submit solutions at regular stages. Additional information is tailored to the students’ responses. In this way the same scenario can take different paths for each group. Support tools include an online tutor and group discussion board and a group reflective diary. Pre-and post surveys of student learning showed that many students moved from taking a surface approach to learning at pre-test to using a deep approach on completion of the online course – one of the aims of using PBL (Waters & Johnston, 2004).

Facilitation is an important issue for the developers of online courses using PBL. Student work in small groups with a facilitator was identified above as a core characteristic of PBL. Introducing online support raises a number of questions, such as can online tools and support guidelines substitute for close facilitation, or can facilitation be effectively done online? Students may work in groups on a problem-solving task with minimal direct supervision. In one study students carried out a problem-based task with an online discussion and guidelines on group work for support, and the option of organising their own meetings face-to-face. Students found this approach to be engaging and staff were happy with the reports produced by students, but some students reported difficulties in managing groups (McAlpine, Scoufis, & Brooks, 2003). The role of a facilitator includes group management and ensuring that students follow processes through and reflect on them. The absence of a reflective process means that students may miss important points that they need to learn (Hmelo-Silver, 2004). Providing facilitation online is a potential alternative. An online module in PBL format in an Art Education course used practising teachers as online tutors to provide students with a direct link to the school environment (Snepvangers & McAlpine, 2004).

Research questions

The effectiveness of PBL has been seen to be contingent on the facilitator (Tan, 2004). In this study, most facilitation is provided online. The research questions are focused on the effectiveness of this environment in supporting the critical outcomes from the PBL activity. Key questions are:

1. How effective is the online facilitation in enabling and supporting cognitive processes that lead to the development of problem-solving skills? This question is focused on how the students used the online environment and how effective it was in supporting their challenge of learning to work on a complex and shifting problem.
2. How can people mange to contribute as an individual in the context of working with other people? This question seems central to the idea of group process and effectiveness of any possible group product.

Research method

To investigate student learning processes and roles and activities within groups, an interpretative approach is used. By triangulating data from different sources, a more complex perspective of student learning processes can be built up (Carr & Kemmis, 1986). To address the research questions relating to online facilitation of PBL and how people manage to contribute as an individual to the working of an online group, knowledge is needed about student perceptions of the problem task and the group process, and about how the students worked as a group to develop a resolution. The investigation was carried out using two indicators of student learning:

1. An end of course survey. This had groups of questions on perceptions of use of the online technology, the resources and guidance provided in the online coursework, cognitive aspects of learning from PBL, group work and group processes, and the overall learning outcomes. Each group of questions was followed by an open ended question to allow qualitative responses.
2. Analysis of contribution to online discussions. The discussions of two groups were selected. The analysis focused on the process students used to resolve the issues and produce a report.

Analysis of these indicators enables an interpretation of perceptions of learning in this mode and its outcomes, and the processes students used. From these, conclusions as to the effectiveness of aspects of the approach can be derived.

Developments in the Art & Design Education course

This study is a follow-up to an earlier study (Snepvangers & McAlpine, 2004) of an upper level art and design education course. The art and design education course occurs in the third year of the Bachelor of Art Education (4 year degree program) and the Bachelor of Design/Bachelor of Art Education (5 year degree program) at the College of Fine Arts (COFA), The University of New South Wales (UNSW). As the third in a series of learning and teaching courses, the complexities of classroom management in visual arts and design are explored. The compulsory course deals with preventative classroom management and issues surrounding the learning and teaching of secondary visual arts and design. The course, occurring in year three, has a pivotal role in the degree programs. One outcome of the course is to inculcate COFA students to undertake a semester long (fourteen week) internship in a secondary school. The internship directly follows the course, so preservice students need to be adequately prepared to undertake collaborative practice based tasks in a professional setting. The students have been into schools previously, however, the internship is a strong indicator of their capacities within a sustained professional environment.

The course has evolved from a clinical supervision model with an eight week in-school component, to, in 2000, a lecture-based on-campus course. The move from a within school component, to lectures acknowledged increasing costs and time involved in deploying full-time lecturing staff into an increasingly busy pool of available schools. Another area which became increasingly difficult to sustain and manage was the requirement in the course that students engage in group activities, such as writing individual lessons to collaboratively generate a group program, thus modelling the practice of real teachers in actual schools. However, it was increasingly difficult for students to get together, to meet face-to-face (ftf) and equitably collaborate on a visual arts and design program. The need to collaborate was ongoing and finding the time to ‘get together’ became increasingly problematic. While the changes structure allayed these issues a different obstacle emerged as, whilst practice-based, limited opportunities were available for students to engage with practitioners to actively practice collaboration and work with classroom problems and issues. An online component for the course addressed two learning dilemmas. First, it was designed as an alternative to the session long, lecture based tradition of writing individual essays with its corresponding focus on the provision of basic knowledge and content overload. Secondly, there is the important consideration for the lecturer who must manage the students’ ability and willingness to collaborate with peers and co-teachers on tasks in the interests of student learning.

Assessment of group work in the past reveals a number of dilemmas; for example, more academically able and committed students often carried the whole group, deserving or not so deserving, towards higher grades. In the new course design group work attracted both individual and group feedback and grades, together with a planned imperative for all students to be actively engaged in the learning task. With the textual base of online discussion new possibilities also emerged for all students to become active participants. An asynchronous written record does not allow you to sit idly by, allowing more capable or committed students to do the work. In other words, a planned level of accountability was part of the revised version of the course, with increased opportunities for interaction and communication, accessible any time. Central to the particular context of the art and design education course and course design was the need to:

- experience group based learning tasks as preparation for collaborative team-based work in a range of diverse secondary, tertiary, museum and community-based contexts
- address the challenge of finding time to ‘get together’ on-campus, in a changed work commitment & study environment
- provide an active learning, group-based alternative to the semester long, lecture based course of writing individualised essays, focused on passive reception and content overload
- manage the student’s ability and willingness to collaborate with peers and co-teachers on tasks in the interests of student learning
- provision of an online classroom management scenario which was salient for students in art and design education.

Online facilitation

The online component of the course is approximately four weeks, occurring in the middle of a fourteen week teaching semester. The online course is structured to:

1 Present the problem scenario. This involved the provision of recommendations to a first year out teacher with a range of classroom management problems. The setting is Manic High School, with ‘The Class from Hell”. To illustrate the complexities of the problem, various individual male and female characters were introduced at various points in the scenario. In addition, Occupational Heath and safety questions about space and Duty of care were subtly knitted into the problem/scenario as the first year out teacher struggled with the vagaries of teaching digital and photographic concepts and skills. The complexity of the localised and particular management situation was central to the scenario.

2 Provide guidelines for the process of making recommendations to the first year teacher, working in small groups.
3 Provide online discussions for each group. The online PBL component uses collaborative online discussion and group tasks to strengthen and scaffold a new set of group learning opportunities, building on the initial task by focusing on reflection, peer interaction and group dialogue. The online discussion component discussed in this paper, was designed to make visible the complexities and connections involved in understanding classroom management as a conversation, using online discussion rather than a series of 'teacher tactics' or 'hot tips' for undergraduate preservice teachers.

A facilitator was appointed for each group. These were practicing art teachers who had brief meetings with the students, but worked mostly online. Their role was to guide the group towards a resolution of the scenario, without providing any 'correct' answers themselves. Facilitation has been identified as an important role in the PBL approach (Hmelo-Silver, 2004). In a classroom environment the facilitator may meet with the students regularly to guide their learning. This is to ensure that the students undertake the cognitive processes required to relate new knowledge to prior knowledge and to elaborate their knowledge by collaboratively developing a solution to the problem. In this case, the facilitator role was split between guidance, support and resources within the online course, and facilitation by online discussion. The scenario setting, resource support and guidance roles of the facilitator are reduced, and the students are given online support for a more self-directed approach. This design was arranged to ensure that the students attained the full benefit of working in a PBL environment.

A short engagement over the four weeks was considered much more effective in terms of generating online discussion, rather than a full sessional involvement. Clear articulation of tasks to be delivered and presented, rather than a mere invitation to participate in the discussion were also key ideas. The short timeframe also allowed for the creation of a virtual professional environment, with the support of external art and design professionals (tutors), active in the field and also engaged in postgraduate studies at COFA. To illustrate developments in the 2004 version of the course, firstly the suggested change is noted then the way the course was transformed is discussed.

- *Provide a stronger rationale for 'why' online learning and 'how' to work online.* To address this question further resources and examples of context and application were introduced very early in the online segment of the course. Group processes were also highlighted through peer assessment and online group skills resources and discussion.
- *Increase lead-in time and technical specifications*. The technical aspects of the task were started much earlier than the first iteration of the course.
- *Schedule one other face-to-face meeting with tutors*. The second face-to-face (ftf) meeting with tutors was scheduled mid way through the task, to provide a progressive feedback loop that went beyond the initial meeting.
- *Reduce content to further focus on learning activities, rather than the presentation of knowledge*. It was hoped that by limiting the scenario to just one smaller section, without the requirement to address everything the complexities, interactions and significance of actions and actors could be enhanced.

The online survey results for the 2004 cohort are considered in the next section.

Results

Technical preparation

One of the matters identified in the previous study of the 2003 cohort was greater preparation for student use of the online technology. Most students in the 2004 cohort agreed with the survey question 'After the initial problems of connection were overcome, access to the online materials was consistent and effective'. The majority of open ended responses (12) were positive. Providing more lead time and direction on using the technology appears to have been successful in preparing the students for an online learning activity.

Online resources

Research Question 1 is concerned with online facilitation. The online materials were designed to provide access to resources needed in the form of readings, guidelines for online study and working in groups, and communication among students in small groups working on the problem task. Each small group had a facilitator who was a practicing art teacher based in a school. The students met with their facilitators, but most of this communication was online. Facilitation was thus a mix of online support and guidance, online communication and meetings. The online materials were designed to form part of the facilitation role. A range of survey questions regarding ease of use of online resources, support and guidance provided all had positive responses on the survey. The students' perception of the online course was clearly favourable. The open ended question showed a much more positive response in 2004 than in 2003, such as:

> Good to see another way of learning – great to actually take part in it.

While not all comments were positive, and some students were less enthusiastic about using the online environment, the majority of the students responded in a positive way. This suggests that the online resources provided an important support role as part of the facilitation process.

Cognitive processes

Facilitation in PBL is there to ensure that an appropriate level of cognitive development occurs while working on a resolution of the problem (Hmelo-Silver et al., 2004). Table 1 shows the questions on cognitive aspects of the problem scenario. At a cognitive level, the PBL approach is designed to present students with a challenge, to foster the elaboration and enhancement of existing knowledge structures while the students construct new knowledge based on their efforts to meet the challenge. By learning that they can resolve complex problems of a professional nature it is expected that students will learn an approach to problem solving that they may apply in a future professional environment. The questions in Table 1 were included to determine whether the students perceived that they were appropriately challenged, that they built new knowledge on their existing knowledge structures, and that they felt they developed problem solving capabilities.

Table 1: Survey questions on cognitive development

			SA	A	NS	D	SD	Mean
13	The problem/project topic had some features that were familiar to me	26	9	13	2	2	0	4.12
14	I found the problem/project topic appropriately challenging	26	4	19	2	1	0	4.00
15	The problem/project enabled me to build on knowledge I already had	26	6	17	2	1	0	4.08
16	I developed new knowledge by working on the problem/project	26	8	17	1	0	0	4.27
17	I learned little that was new by working on the problem/project	26	1	5	1	15	4	2.38
18	I learned a method of approaching new problems by carrying out the problem/project tasks	26	5	16	3	2	0	3.92

Note. SA – Strongly agree, A – Agree, NS – Not sure, D – Disagree, SD – Strongly disagree.

The data from Table 1 suggest that the students' perception was in accord with the intended outcomes from these processes. A later question (question 30) indicates that the problem skills would be valuable to them in a professional capacity, an important intention of the PBL approach to this course. Open ended responses from both cohorts were mostly positive. Comments from the 2003 cohorts suggested that there were too many problem tasks, which made the activity too large to address effectively. The students were given a choice of scenarios to respond to in 2004, to ease the volume of work. Comments from the 2004 cohort suggest more positive perceptions of the process.

Facilitation and learning outcomes

Table 2 indicates that the students responded positively to questions about facilitation and their perception of the learning outcomes. They were strongly positive about developing problem-solving skills that they felt would be useful to them professionally – one of the main aims of the PBL activity. They were less positive, however, about the effect of the course tutor – the group facilitator in this case. Some open-ended comments elaborated on these perspectives.

Table 2: Survey questions on facilitation and learning outcomes

			SA	A	NS	D	SD	Mean
28	The course tutor provided effective guidance and feedback	25	2	11	3	8	1	3.20
29	I felt that I developed a deep understanding of the course content	26	4	16	3	3	0	3.81
30	My studies in this subject helped me to develop problem-solving skills that will be useful to me professionally	26	7	15	4	0	0	4.12

Note. SA – Strongly agree, A – Agree, NS – Not sure, D – Disagree, SD – Strongly disagree.

Comments on the problem task were generally favourable, such as:

> Activity was one of the most useful activities in teacher development because it had a practical side to it as well as the cooperation amongst a different familiar group of people.

The online environment was also seen to be effective:

> I think it was structured very well with many support systems in place. It was actually very comfortable learning environment as we knew where and how to get help and knew clearly what was being asked. This led to more constructive time on task and created a more meaningful group environment.

Comments about the facilitator, however, were more equivocal, such as:

> Our tutor was helpful in the face to face meetings, however she did not provide us with any feedback on our solutions. I feel she could have even posted more messages about how we were going. We did not even know if we were on the right track.

In response to the first research question, the students appeared to be happy and supportive of the overall facilitation provided for the activity by the online environment, and they perceived that they had developed the critical teamwork and problem-solving capabilities that the PBL activity was introduced to develop. Surprisingly, the support and guidance provided by the facilitators were less valued. Additional consideration of this role appears to be needed.

Group processes and online discussions

To address the second research question about how and what can individuals manage to contribute in the context of working with other people, the content of the online discussion was analysed to investigate the problem-solving process. Two groups, A and B, are focussed on for the purposes of this paper.

Problem definition

Following a brief introductory post to all groups by the course lecturer, the online discussions that were analysed focused mostly on group process, how to respond and make meaning of the task and aspirations for group functionality. For example: in Group A, the first post is a hello and hope you are enjoying your break type post, then another student begins to suggest an organisational structure for the whole task and group to follow. The post proffers advice from a student perspective about technical requirements by offering an interpretation of the lecturers post, rather than responding to the lecturer directly:

> … the best way to see everything is to make sure you have the ‘threaded’ button clicked. And also make sure the ‘all’ button is clicked. This means that we can have the problems organised into folders you can see, and all our responses under each, thus this would keep everything easy to view/keep us going off topic.

So, right from the beginning students were making autonomous moves about how to negotiate and work with the problem, firstly as a technical exercise. However, embedded within these more instrumental posts are clues about the social and motivational aspects of working collaboratively. For example, in the quote above, the student uses the words ‘we’ and ‘our’ to begin to suggest a working relationship, without presuming that everything will always be completed as a group ‘we’ together.

Planning an approach as a team

The students moved through preoccupations with being correct with both technical matters and the requirements of the task. Questions about ‘How will we work?’ are supported by lengthy posts, which set out an analysis of the problem using headings compiled by individuals who suggested a structure for the group to work within. The online collaborative environment meant that all of the readings were read with some groups dividing the reading amongst group members. The most successful groups provided an organisational format to structure the reading for all group members to follow so that readings are completed with a question in mind, or some other recording device is planned to collate individual postings.

Research and investigation

> Hey so are we going to pick, for example, a problem [name of student] identified and turn it into a thread and then come up with better solutions in that particular thread?? Just trying to make sure I understand before I analyse a problem and post something. (Group A)

This post is directly followed by:

> Hey [name of student] – this is a good point as I guess we didn’t really specifically discuss what we were going to post after all but maybe at this stage it is good just to brainstorm (at least that is what I did). then soon we can choose which areas to expand on as individuals in conjunction with the reader and questions we need to answer?

The task and scenario highlight how preventative approaches to classroom management involve collaborative work by a range of individuals, in other words a group task. Each scenario can be understood in terms of a range of factors (physical, social, relational) which can be thought about in advance and are specific to a particular context. By designing the activities and system support as a group task with online resources, one of the main outcomes of the activity is that individual students don’t feel that they have to solve all of the possible management scenarios in every possible future classroom environment on their own. The two quotes above prefigure the range and kind of actions needed to resolve through discussion and deferral, particularly complex classroom management dilemmas. This was in addition to their individual contributions. The most successful groups made one set of documents for contributions to be made, or they delegated each team member one of the tasks/readings.

Developing a resolution

Through the research and investigation phase one student in Group A reported on what everyone had completed to date. The post even reports on what was agreed at the last lecture and who left early, and who was not available on their mobile phone. For this student the role of equity and inclusion was paramount to group process. Other actions that lead towards a resolution of the task included:

- questioning assumptions by clarifying previous posts
- asking fellow group members to “disregard what I said” and deferring to others
- reflecting and re-interpreting what has been said from your own viewpoint
- tracking each other
- creating a new thread for the completion of the task.

Discussion and conclusions

Taking a PBL approach using online technologies to provide a learning environment to support the process may be a way to enhance student learning outcomes. In this study the transition from lecture and essay-based course to an experiential PBL approach has brought about a significant enhancement of learning outcomes. Students were faced with the complexity associated with a real school environment, both in relation to the problem scenarios and the requirement to work as a team to consider all of the ramifications of the scenario and the most effective way to resolve it. Online technologies played a major role in enabling the group process, by providing online access to resources, guidelines and communication among students and with the group facilitators.

Group process, actions and operations made manifest in the manner of conducting oneself in response to the activity, dominated online discussions. In other words, how the group began then maintained functional operations to address the task, was the topic of the majority of postings throughout the online discussion. Other key observations from the discussion include:

- the important role an individual can play in moving the content, meaning and significance of the activity forward, using social dimensions; for example: collaborative and inclusive language and reportage, or suggestions made as drafts
- the importance of delegation; for example in two successful groups one person has been allocated the task of organising the responses, making tables and collating group material
- the way that online discussion allows all members of a class to contribute in an inclusive way
- the respect for each group member and their contribution to the task and some of the difficulties if all group members are not participating or using effective social dimensions in group process
- importance of autonomy and independent choice in a given activity, together with some key ideas in relation to group functionality.

The success of PBL has been seen to be dependent on the effectiveness of the group facilitator. In this course, the role of the facilitator was divided, as the facilitator did not manage the group process. Presentation of the problem scenario was online, as was access to resource materials. Much of the guidance for working in groups, normally provided by a facilitator, was also online. Online discussions enabled communication processes among group members that remained there for reference and later reflection and review. The online discussion became a group artefact, an evolving document in the same way that the group reports evolved as a product and a reflection of the group's approach to the task. The group facilitators were part of the online discussions. Their role, however, was less active than is traditionally expected of a PBL facilitator and, as the students observed, less critical to the outcomes of the task. 'Facilitation' through the medium of the online environment appears to have enabled the students to work in self-directed groups and to reduce the reliance on a teacher as facilitator. This is a potential benefit of an online learning environment used with a PBL approach – one that is worth investigating further.

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Impact of video recorded lectures among students

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This study evaluates the impact of video recorded lectures on students who have accessed them as part of their studies at the Nanyang Technological University. A survey was designed and administered to this group of students. In addition, data on the usage of video recorded lectures between July 2005 and June 2006 was extracted from the server. The findings indicated that the usage among students has been far beyond expectations. It also suggested that the video recorded lectures have benefited the students as it has enhanced their learning experience in the University.

Keywords: teaching and learning strategies, ICT policies and strategies

Background

Nanyang Technological University (NTU) started introducing e-learning to both faculty and students in year 2000 via a learning management system, Blackboard. The Centre for Educational Development (CED) takes on the main the responsibility for providing support to academic staff and students to ensure effective teaching and learning practices within the University. In relation to this, CED has embarked on a project which involves the video recording and digital archiving of lectures. The objective of the project is to enable faculty to have the flexibility to place recorded lecture links in Blackboard for their students to view. Figure 1 shows the screenshot of a streaming video recorded lecture. As part of this project, CED has sought assistance and active involvement of student-led school clubs in capturing the lectures on video and the post-production processing. Each school in the University has a student-led school club which looks into the academic and welfare matters of the students.

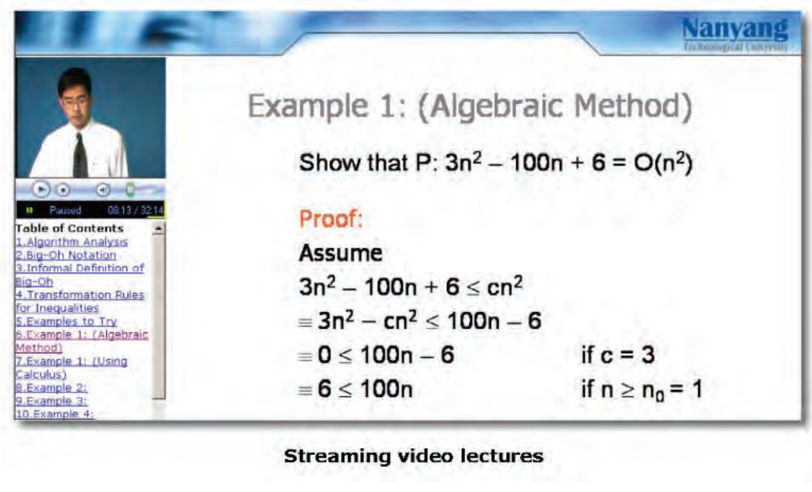


Figure 1: Screenshot of a streaming video lecture

The video recording of lectures project was done in collaboration with school clubs. The school club sub-committee recruited members to record the lectures and were previously awarded extra-curricular points under the Points Award System (or PAS). These points go towards the allocation of student housing. CED provides the infrastructure support and training to the school club members in this project.

Since the project started in July 2003, seven student-led school clubs took the initiative to embark on this project and formed club sub-committees to manage the recording of lectures for their respective schools. Lectures were recorded based on mutual consent by the school club and the instructors.

The study aims to find out the extent the video recorded lectures have been used by the student population.

Use of video in education

Research has shown that the levels of attention of students in a traditional lecture will tend to decline rapidly after 20 minutes. (Middendorf & Kalish, 1996). Hence, students who attend lectures may have difficulty in focusing on a 1-hour or 2-hour lectures in the University. Foreign students, especially freshmen, who may not be conversant in English, often find it even more difficult to focus during lectures as they have to comprehend the content and language at the same time.

The video provides a face with expressions, gestures and a human voice to what is usually ‘faceless’ online content, which according to the social-cue hypothesis stimulates students interest and communication, and therefore influences learning in a positive manner (Dewey, 1913; Rutter, 1984).

It is also important that such video presentations should have much learner control as these video presentations are targeted at adult learners, mainly at undergraduates, who tend to prefer self-directed learning approaches (Knowles, 1980). Asynchronous access has been found to be equally valued for both empowering the learner with control of the lecture and convenience (Simpson, 2006). The system adopted by NTU for video recorded lectures allows learners to access any segment of the lectures easily through a table of content. Learners can easily click onto any particular topic under this table of content to view the segment. Learners are also able to re-play, start or pause the video streaming.

Methodology

All students who have attended lecturer sessions that were recorded were invited to participate in the survey. The survey was carried out by school clubs, with assistance from CED to students attending lecture sessions that were recorded. A questionnaire was designed. The questionnaire contains two sections: (1) the profile of students, and (2) feedback from students on the use of video recorded lectures. There is a total of 23 items found in the questionnaire. In addition, data on the usage of video recorded lectures between July 2005 and June 2006 was extracted from the server.

Findings

A total of 1160 students completed and returned the questionnaire. The return rate is 38.9%. The majority of the students surveyed are from year 1 and 2 (N=954, 82.2%) while the remaining 206 (17.8%) are from year 3 to year 5.

Point of access

Almost an equal percentage of students accessed the internet for video recorded lectures most frequently from home (N=1160, 37.5%) and hostel (39.1%). The remaining percentage indicates that the students access these video recorded lectures mainly from various other locations within the campus.

Usefulness of recorded lectures

94.9% (N=1140) of the students agreed (either strongly agree or agree) that the video recorded lectures are useful in relation to their studies in NTU. This is based on a 4-point scale question on the usefulness of the video recorded lectures.

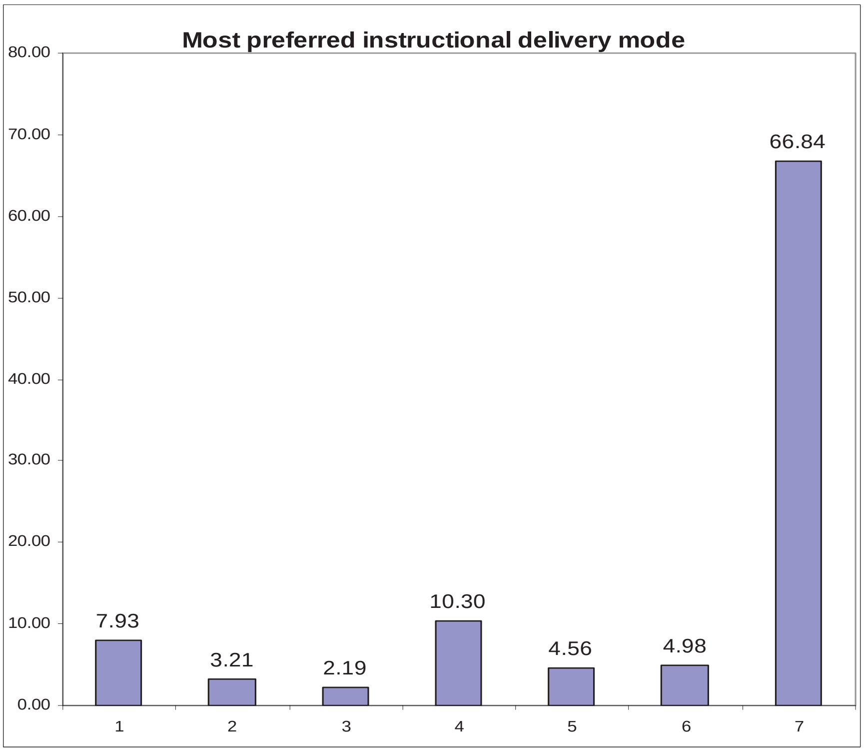
Quality of recorded lectures

Another 83.0% (*N*=1142) were satisfied (either strongly agree or agree) with the quality of the video recorded lectures. 95.8% (*N*=1067) of the students surveyed agreed (either strongly agree or agree) that these video recorded lectures should be continued in the following semesters.

Viewing patterns

It is noted that 48.3% (*N*=1134) of the students view selected portion of the recording repeatedly until they understand it while another 29.2% view the whole recording. 13.8% of the students surveyed view selected portion of the recording once for revision while 8.7% did not find the question applicable to them.

Majority of the students surveyed (*N*=1165, 66.8%) indicated that their most preferred instructional delivery mode is a combination of lectures in lecture theatre, with video recorded lectures and uploaded course documents on Blackboard (Figure 2). This finding suggests that students prefer 'whole package' of instructional modes be made available for them.



1 = lectures in lecture theatre (LT)
2 = video recorded lectures
3 = uploaded course documents in Blackboard
4 = lectures in LT, with uploaded course documents on Blackboard
5 = lectures in LT, with video recorded lectures
6 = Video recorded lectures, with uploaded course documents on Blackboard
7 = lectures in LT, with video recorded lectures, and uploaded course documents on Blackboard

Figure 2: Students most preferred instructional delivery mode

Based on Table 1, it is noted that one of the main reasons why students access video recorded lectures is to watch selected parts of the lectures in lecture theatre which they do not understand (*N*=904, 34.5%).

21.5% of the students indicated that they access video recorded lectures as it helps them in preparing for examinations. Another 18.1% shared that they access video recorded lectures as it can be accessed anywhere, anytime.

Table 1: Main reasons why students access video recorded lectures

Reasons	%
I find the video recorded lectures help me in preparing for exams	21.46
I can view the recorded lectures anywhere, anytime	18.14
I do not have to get up early for lectures	7.52
I am too busy to attend classes	4.54
I find the lectures in LT not interesting	1.33
I can watch selected parts of the lectures in LT which I don't understand	34.51
I access video recorded lectures when I am on MC	10.73
Other reasons	1.77

From July 2005 till December 2005, the number of accesses by student was 114,204. The aggregated viewing duration (that is, summating the viewing duration of all students) amounted to more than 48,000 hours (Table 2). This translates to more than 5 years of continuous viewing for that semester. For the period between January 2006 and June 2006, the number of accesses by students exceeded 170,000. In addition, the aggregated viewing duration amounted to more than 68,000 hours (Table 2). This translates to more than 8 years of continuous viewing for that semester. This is interesting as we have a significant proportion of students on industrial/professional attachment during this period.

Table 2: Number of hits and duration viewed

	No. of presentations/ lectures recorded		No. of hits		Duration viewed (hours)	
Semester	July till December 2005	January till June 2006	July till December 2005	January till June 2006	July till December 2005	January till June 2006
Total	950	1,773	114,204	171,998	48,231	68,719

Discussions

The findings of this study suggest that the students have benefited from accessing video recorded lectures. Feedback from students indicated that such recordings enable them to access parts of lectures which they do not understand. Some students also indicated that these recordings help them in preparing for examinations. Students also find the video recorded lectures provide them with the flexibility in accessing it anywhere, anytime.

One observation from the study is that students would prefer to have a combination of face-to-face lectures, video recorded lectures, and uploaded course documents on Blackboard. This shows that students still value face-to-face lectures despite the introduction of technology into the various courses in the University.

One area of research which can be carried out in future is to find out why students who enroll in certain subjects tend to access video recorded lectures more often that other group of students. The findings of such research would help educational technologists make more informed decisions when assisting faculty members in the planning and development of online course materials.

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Influence of teacher beliefs on web-enhanced learning experiences: Learners and teachers

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Research into teacher beliefs and practices in a web-enhanced environment have often failed to consider the influence of participant belief systems about web technologies in learning and teaching contexts in conjunction with these beliefs more generally. The findings from this study emerged as part of a larger PhD investigation into university teacher beliefs about web technologies, learning and teaching, and the enactment of these two belief systems in practice. For this paper, the influence of the belief systems of three award-winning university teachers on practice is explored in relation to learners and teachers and the design of web-enhanced learning experiences.

Keywords: academic teacher beliefs, web technologies, e-teaching, web-enhanced, learning experience, learning design, academic development

Introduction

Research into the beliefs of teachers using web or computer technologies has usefully examined teacher beliefs about web-enhanced learning (e.g. Keppell, Cote, Leung, Jones, & Richards, 2004) and the relationship between teacher's beliefs about learning and teaching and their technology-enhanced practice (e.g. Bain & McNaught, 2006; Goodyear, 2002; Reeves & Reeves, 1997). However, few studies have sought to understand the influence of academic teacher beliefs about web technologies themselves in a learning and teaching context (Ertmer, 2005). This paper, based on findings that emerged from a PhD study (in progress), focuses on the role and relationships of learners and teachers in the stories of three academics who were recipients of The University of Queensland (UQ) Excellence in Teaching Awards and who had incorporated web technologies into their teaching practice. Using a combination of concept-mapping and stimulated recall tasks and interviews, these roles and relationships were explored in terms of the influences of participants' beliefs about learning and teaching, their beliefs about web technologies (in a learning and teaching context) and the design of web-enhanced learning experiences

The study context

Increasingly, academic teachers are using web technologies to add value to or replace other forms of university teaching. Their web sites are tangible and dynamic constructions that represent the teacher's thinking and decisions derived from implicit belief systems about teaching, learning and the use of web technologies (Steel, 2003). The integration of web and other new and emerging technologies into university teaching practices holds both opportunities and risks for the quality of university education. For this reason it is imperative that a better understanding is gained of the influence of teacher's beliefs about web technologies and those about learning and teaching.

Research context

The use of web technologies in higher education is increasing in most universities and is an important area of focus in academic staff development. Many researchers in this field agree that if academic staff developers are seeking to assist teachers to improve their practice they need to find ways to make explicit and influence teacher beliefs (Ho, 2000; Kane, Sandretto, & Heath, 2002; Kember, 1997; McAlpine & Weston, 2002). School-based studies into beliefs of exemplary technology-using classroom teachers have been revealing and have had implications for teacher development programs (Ertmer, Gopalakrishnan, & Ross, 2001). For example Ertmer et al. (2001) found that 'no one vision of teaching and learning motivates teachers to strive for exemplary use' and that their visions encompassed 'multiple emphases' dependant on their perceptions of the needs of their students and their jobs as teachers. The authors stressed that while teachers required good access and support for technology use, this was unlikely to engender exemplary practice. They proposed that teacher development designed for teacher growth, access to expert examples, visions and strategies would be more useful.

In both school and university education, the study of the beliefs and/ or practices of effective, experienced, award-winning or expert teachers has proven to be illuminating (e.g. Ballantyne, Bain, & Packer, 1997; Dunkin, 1995; Dunkin, 2002; Kane, Sandretto, & Heath, 2004). Exemplar academic stories such as those documented in the substantial work of Ballantyne et al. (1997) made the thinking, beliefs and decision-making of effective teachers more accessible in order to 'promote academic reflection and discourse on the quality of teaching in higher education' (p. xiii). Much can be learnt from exploring the implicit professional thinking and beliefs of experts. Research conducted by Dunkin (2002, p.55) found that, like many school-based studies, expert teachers possessed a complex and rich repertoire of thinking about effective teaching. In reflecting on one's own teaching, much could be learnt from making ones own beliefs and practices explicit and perhaps drawing on insights from case studies on the beliefs and practices of exemplar teachers.

Bates and Poole (2003) proposed that 'the choice and use of technology are absolutely dependent on beliefs and assumptions we have about the nature of knowledge, how our subject discipline should be taught, and how students learn' (p.25). This study attempts to make explicit the beliefs and practices of three award-winning university teachers from three different disciplines in relation to learners, learning, teachers and teaching. Exploring the beliefs and practice of these expert teachers provided rich data that illustrated a variety of approaches to thinking in different disciplinary contexts.

Methodological approach

The selection of a case study methodology is appropriate for a study that is largely seeking to understand 'how' certain contemporary events occur (relationships between belief systems and their enactment in practice) and 'what' in an exploratory sense (implications for practice and for academic staff developers). Yin (1994, pp. 5-9) suggests that when these 'how' and 'what' conditions are present, a case study design is appropriate. He also grants that a researcher can use more than one strategy within a case study and these strategies do not need to be mutually exclusive (1994, p.9).

Participants

The candidates for the three case studies discussed in this paper were all Excellence in Teaching Award-winners at UQ and were part of a larger sample in the PhD study. All participants were selected purposively from two population pools that are representative of similar academics and faculties across UQ. Purposive or judgment sampling, a common type of sampling in qualitative research, involves the researcher using their experience and prior knowledge of groups to select participants according to clear criteria (Gay & Airasian, 2000, p.138). For the larger study it was essential that all participants were academic teachers who were using web technologies in their teaching and possessed a belief system about web technologies themselves. In all cases the academics were using a commercial Learning Management System (Blackboard) to create web-enhanced learning experiences via their course website.

The teachers discussed in this paper represent both Science-based and Arts-Humanities based disciplines. At UQ, teaching award winners undergo a rigorous application process that includes initial nomination by at least five people who are academics or students (at least one of each). The reader should take into consideration that the application process itself can influence how academics articulate their teaching practice. The participants represented in this paper had a range of teaching experience from between five to more than ten years and all held at least one education related degree. One had been using the web in their teaching for 3 to 4 years and the remaining two had used it for 5 to 10 years. In terms of their experience in designing an online component for their courses, one had designed 2 or 3 sites, one had designed 4 or 5 and one had designed more than 6. The three participants were between 36 and 55 years of age.

Data collection

The main sources of data collection were stimulated recall, concept mapping and associated interviews. Additionally, a short questionnaire was completed by participants to extract primarily quantitative background and demographic data. A pilot study was conducted in 2002 to investigate the effectiveness of concept mapping and stimulated recall to reveal academic teacher beliefs and how they are enacted through learning designs for the web (Steel, 2003). That study concluded that the use of concept mapping and stimulated recall as data elicitation techniques were useful in this type of investigation. Both techniques were used in a similar way for this study. Participants completed an interview using their course website as the artefact that was their stimulus for recall. They then constructed two consecutive concept maps each followed by interviews (i.e. concept map 1 then interview, concept map 2 then interview).

Stimulated recall activity

Stimulated recall is a method that attempts to access a person's meta-cognitive knowledge in response to a stimulus (Keith, 1988). Cues that are inherent in the artefact, in this case a course website, stimulate the participant to access and verbalise an account of their beliefs, thought processes and ideas in relation to the stimulus (Calderhead, 1981, p.212). As the participant would not actually be designing or implementing their site during the interview, the teacher would be recalling decision-making and student responses retrospectively. In this study, and in the pilot study, the limitation that *retrospective* verbal reports may not be entirely accurate must be acknowledged. One must also take into account that there is always some slippage between what one recalls and actuality, and that most tasks of this nature involve a level of complexity that it is nearly impossible to express using language.

A semi-structured interview with guiding questions prompted each participant to explain the design of the learning experiences available via their website and how these were intended for student learning. Each site had been implemented at least once with learners and most recently in the semester prior to data collection. The data was collected using a cassette recorder and an on-screen capture software Camtasia™ that recorded the voice in synch with screen capture and mouse movement culminating in the creation of a video file. All participants provided the researcher with their course outlines and ongoing access to an archived version of the course website. Access to these two resources meant that clarity could be sought during data analysis as required.

Concept mapping tasks and interviews

Concept mapping is said to assist in making declarative knowledge, including the relationship between concepts, visible. The concept mapping method has been used extensively in science education research and more recently in studies of expert and novice knowledge domains (Olson & Biolsi, 1991, p.240). It also offers researchers a way of documenting and exploring participant propositions in relation to their belief systems. Concept maps have drawn criticism regarding reliability and validity issues, however, Novak (1998) advocates that these issues are addressed in the natural transparency of concept maps. Validity, he says, can be appraised through the propositional relationships and the hierarchical structures of the map itself (Novak, 1998, p.192).

Each participant constructed a paper-based map about their beliefs about web technologies in a learning and teaching context first, and after an interview on that map, proceeded to a second paper-based concept map on their beliefs about learning and teaching. This was again followed by an interview. Pre-printed sticky labels were provided for each concept map along with blank labels for the creation of participant's own concepts. The participants were told that they were under no obligation to use any of the pre-printed labels except for the overarching concept (i.e. Web technologies & learning and teaching). They were also able to change the wording on any of the labels if they so desired. The use of the pre-printed labels (see Table 1) served several purposes including guidance and scaffolding for the activity which provoked participants to think about their beliefs in relation to some broad ideas around the overarching concepts. This strategy also assisted with cross-case analysis. The use of the words 'can' and 'cannot' (with propositional arrows) and 'effective', 'ineffective' and 'role' was to incite participants to express their beliefs in terms of both positive and negative propositions so that a fuller picture of their belief system would emerge. Most participants used the majority of the labels in addition to their own self-created concepts. The original concept maps were later converted to electronic format by the researcher using a concept mapping software called IHMC CmapTools™. The researcher believed that having the participants construct the maps in a paper-based form was less cognitively demanding and meant that they could concentrate on the task at hand (representing their beliefs and mapping relationships visually).

Table 1: Pre-printed concepts

Overarching concept	***Web technologies*** (Concept map 1)	***Learning and teaching*** (Concept map 2)
Optional concepts	Can	Effective learning
	Cannot	Ineffective learning
	Role of web technology	Effective teaching
	Effective web technologies	Ineffective teaching
	Ineffective web technologies	Creates knowledge
	Effective (web) teaching	Creates learning experience
	Ineffective (web) teaching	Role of learners
	Effective (web) learning	Role of teachers
	Ineffective (web) learning	Role of content
		Role of assessment
		Role of feedback

A semi-structured interview was conducted to access a narrative account of each concept map. A set of guiding questions were developed prior to the interview but ad hoc questions were used during interview to follow certain lines of inquiry. A semi-structured approach allowed some flexibility in the mutual construction of the account while assuring that core issues were canvassed.

Data analysis

Analysis for this type of research typically consists of using an inductive grounded approach (Glaser & Strauss, 1967) where categories of beliefs emerge from the data (Kember, 1997, pp. 258-259). Transcripts of stimulated recall interviews were analysed in tandem with viewing the Camtasia™ video files, the archived website and course profiles as required. This assisted in re-examining evidence of participant claims in practice. The transcripts of the concept map interviews were analysed while viewing the concept maps (in both original and electronic formats) to assist in the exploration of propositional relationships and inter-relationships between concepts. All transcripts were read and re-read consistently throughout the different stages of data reduction as recommended by Miles and Huberman (1994, pp.10-12). Data analysis was further facilitated by the use of QSR N6™ to manage data and locate patterns and themes.

Findings

The three participants in this paper are known by the pseudonyms Kara, Jack and Tulula. This section presents some of the findings about their beliefs about learning and teaching, about web technologies in relation to learners and teachers, and how these were enacted in their web-enhanced learning designs. Initially their beliefs and practices are presented followed by a discussion of common and diverse themes that emerged from the data.

Beliefs: Learning and teaching

Kara on learning and teaching
Kara envisaged the relationship between teachers and learners to be likened to a craftsman and apprentice. As an apprentice, students needed to *want* to learn from someone whom they presumed has the disciplinary knowledge and expertise. She was concerned about recent debate around client-service provider models in universities as she believed that as a client, the learner may ‘expect things that may not actually deliver any sort of learning to them’. The role of the learner though, was ‘extremely important’ in the enactment of learning as teaching and combined with the quality of teaching, it determined ‘whether knowledge actually gets created’. Core to Kara’s beliefs were the critical roles of communication, socialisation, scaffolding and disciplinary content in student learning.

Jack on learning and teaching
For Jack, the whole aim of learning and teaching was to get students so motivated, enthused and interested that they thirsted for yet more knowledge. He saw the relationship between learners and teachers as having an equitable participatory role in the creation of the learning experience however the teacher was responsible for trying to ensure it was positive and that students were stimulated and engaged. Learners, he believed, need to be given the opportunity to explore, discover and engage in disciplinary content and research so that knowledge formation became process orientated rather than broken into disaggregated recitable facts. Jack also acknowledged that because there is so much variability amongst students, a learning experience that might be powerful for most students, will not necessarily be effective for all learners. He believed that teachers need to monitor learner responses to 'reinforce or re-evaluate our overall teaching philosophy'.

Tulula on learning and teaching
Behavioural change in students in relation to their professional context and conduct was a core aim of learning and teaching for Tulula. She believed that learners and teachers, as collaborative partners, co-created the learning experience. However, the locus of control for learning was firmly in the hands of the learners. Learners, she believed, can build knowledge in a number of ways. For example, they can create knowledge socially with their community or solely through working towards an assessment piece. They use their prior knowledge, teacher feedback and hopefully learn how to evaluate and monitor their own learning to help them create their knowledge. Tulula conveyed that a learner's self-schema, social context, self-concept and motivation also impacted on student learning, and in view of these, it was the teacher's role to select content cognizant of learner needs and interests, and to create assessment and select pedagogy congruent with the nature of the content and assessment. She also believed that 'it would be foolish to imagine (you would have) an environment where only effective teaching occurred'. Teachers 'cannot control the space, you can't control (learner) social interactions… their motivations or where their heads are at on a particular day'.

Beliefs: Web technologies

Kara on web technologies
Web technologies, Kara believed, were tools that needed to be combined with a teacher's educational knowledge in order to be of value in a learning and teaching context. Technology-driven or 'build and they will come' approaches were not acceptable to Kara. A good web-based learning environment, Kara believed, needed to be learner-centred and educationally driven.

> My beliefs are that as a teacher you need to be pedagogically aware and obviously have good discipline knowledge. You need to be aware that technologies by themselves are not going to do the job for you. You, as a teacher, have to take the tool and combine that with your innate educational capabilities to create a learning environment.

Kara strongly believed that both teachers and students needed to be engaged with the online course community. She was particularly committed to providing an equivalent learning experience for her on and off-campus learners and thinking about how students learn using the web and how to design for learner inclusiveness and engagement. She believed in creating a flexible, student-centred design with strong opportunities for interaction, communication and socialisation amongst students and with the teacher. Such learning designs, she believed, provide opportunities for students to feel more engaged and motivated and to receive just-in-time feedback and scaffolding. Reflection was an important issue 'for the lecturer and also for the students'. Getting students to 'reflect on what they have learned and the types of technologies they have used' gets them to start to understand 'how they're learning themselves, what they've learned from' and how they have engaged with the disciplinary knowledge.

Jack on web technologies
During the construction of his concept map, Jack 'wrestled with the idea' of placing the concept of 'web technologies' at the top of his map. He resolved that it was the teacher's principles of learning and teaching that should drive the use of web technologies to support the objectives of learning and so they were placed above web technologies. Of particular concern to Jack was that the focus of the online learning designs should be on the learner and learning, not on the teacher or the technology. The teacher

is there to provide guidance and design active learning tasks that assist students to gain disciplinary knowledge and deep understanding.

> One of the things you worry about with technology, I guess, is (learners) just clicking, randomly clicking. And I want to put in here ‘bells and whistles’ - you know that very fancy kind of software with all the bells and whistles? It all becomes the focus rather than the learning itself.

For Jack, a major affordance of web technologies was the way they could enrich face-to-face learning. He believed it offered him opportunities to engage students in different ways than he can in his large on-campus classes. A well designed course website could be used to stimulate deep and active learning thus helping reinforce and illustrate content and theory. The web also provides a safe learning space to move learners out of their comfort zone a little. Using online communication, learners can ask questions, Jack can probe their knowledge, and students can provide ‘informed responses without the glare of the other 149 students if they get it wrong’.

Tulula on web technologies
Tulula believes that, in an educational context, web technologies are a tool that may be employed to support the aims of learning and teaching. In particular their use enables alternative types of communication and connectivity that can create a socially and culturally inclusive learning environment that value-adds to other learning experiences. Tulula stressed the necessity for high quality educational design so the whole package is designed coherently. Learners may ‘feel confused and panicked by the web technologies’, and if the site is overly complex or busy ‘they might feel directionless and powerless with their own learning’.

> Students should feel comfortable and motivated by the technology, by the environment, by how the package fits together, and that’s one of the key challenges of using technology because so much is available to you, you can make something overly complicated.

The ability for the learner to understand linkages within the whole learning package, and apply them to the authentic experience, are key points that embody Tulula’s thinking about effective web learning. She believes that learners should be able to articulate their learning, what it is that they have learnt and what it means to them and their profession. The web provides opportunities to connect learners to diverse resources and sources of expertise. When the web learning environment is designed for social interaction there are opportunities for learners to predict and test their ideas with others and to hear themselves articulate the knowledge they are creating.

Practice

Kara’s website
The course website that Kara chose to use for the stimulated recall interview was designed for an undergraduate (3rd year and above) course with approximately 50 students. In practice, Kara’s website was a hub of activity and a strong socialisation mechanism for learners and for herself. She provided a thorough orientation to students about how she expected them to engage with the site at the commencement of semester. Initially, she felt students expected that they would not need to think about the course again until they turned up at the lecture again or were completing an assignment. However her design meant learners needed to be more committed and involved with the course. She said that learners ‘end up having to change (this thinking) radically’ as ‘they suddenly realise that they’re going to actually have to be involved in this course almost on a day-to-day basis’.

Kara’s site invites learners to critically analyse and participate in professional ideas, communities, tools and resources. Learners, as apprentices, are encouraged to engage, communicate, discuss and share knowledge through their interactions with her disciplinary knowledge and expertise that are available online in structured html modules. Kara designs real and virtual world ‘hooks’ (stimulus) and authentic assessment tasks such as group projects and focused online discussion topics based on disciplinary issues, concepts and research. Her design proposes to incorporate learner interests and stimulate their prior knowledge. Multiple scaffolding mechanisms are used and Kara clearly conveys her expectations about the desired quality of learner contributions. Her design offers both on and off-campus learners the opportunity to cross-fertilise ideas and experiences and engage in the learning experience without any significant differentiation. Using her online communication mechanisms Kara acts as facilitator, coach and co-learner. For Kara this constant connectivity through the site helps to eliminate the internal-external student divide, to be inclusive of geographically dislocated students and to build a course culture and sense of community amongst learners and with herself.

> It develops a course culture around students interacting with each other, and with me. I find the students seem to be almost friendlier with me. They are at much more ease with me as the lecturer, because I am part of this discussion all the time.

Students must submit a non-assessable reflective document at the end of her course where they monitor how and what they have learned. The structured format and communication mechanisms are cited by her students as being highly influential to their learning.

Jack's website

The course website that Jack chose to use for the stimulated recall interview was a first year undergraduate course with approximately 230 students. Jack designed his website in consideration of his diverse learners who ranged greatly in their age groups, background, education and exposure to web technologies. He believed that students often bought into a myth perpetuated by 'the US movie image of having big lecture theatres' that university education was just a didactic lecturer to student experience. He wanted students to think about the course on a weekly basis rather than just when assessment was due. Concerned with 'breaking the myth as quickly as we can' he ensures that 'in tutorial in week one, the very first thing they do is to log on'. This includes an orientation of the site where 'we take them through the web site so they become familiar with the tools, how they are used and how they are accessed'. He hopes that 'we encourage the younger students who are computer literate and hopefully have no phobias or anxiety to use the computers so we can engage them'. For the mature-age students 'we are developing their skills and we show them that this particular website is not going to bite them in anyway'.

Communication was an important aspect of the website. Jack believed that 'a lot of things happen within this course that demand communication' and that the web technology 'seemed to be a very useful tool for that'. The website included 'all the learning activities for this course' and the students had to participate 'in various activities at various times' that were non-graded but 'required'. The almost weekly online activities provided an opportunity for students to engage with disciplinary research and apply theoretical concepts using quizzes, surveys, role plays, scenario analysis and simulation games. Jack held the belief that 'if learners can experience the theory I think that leads them to have a better understanding of it'. Students were given the opportunity to 'replicate the research' in this course and with the use of online tools data could be quickly aggregated and then presented in tutorials for further discussion.

Jack felt that the lecture and tutorial model without any other contact reinforces the compartmentalisation of learning. He emphasised that the greatest benefit of having this ongoing connectivity through an online presence is that it 'seems to break down that barrier somewhat because now students know that they can find information about my course, communicate either synchronously or asynchronously with their lecturer and other class members and engage in learning materials at any particular time'.

Tulula's website

The course that Tulula chose for her stimulated recall interview was an undergraduate (3rd year and above) course with between 100 and 150 students in their final semester of study. The website component of Tulula's course was developed as a deliberate blended learning strategy to entice students to participate more fully in the course. Tulula was aware that students in their final year of this undergraduate program were reluctant to come on campus to lectures as they had just returned from some practical vocational experience. It was important to find ways for students to cover the core issues raised in the course whether they were on-campus or not. However Tulula felt that she didn't 'want learners to feel as though they could throw away and burn their books and the other materials'. The course included a textbook, a printed learning guide, offline activities, some lectures (not many), optional face-to-face workshops and a compulsory two day face-to-face conference where all students had to articulate their own research and learning. An initial face-to-face course orientation combined with a framework offered on the course website showed learners how the whole course fitted together.

The website provided online tutorial support, diverse authentic resources and interactive tools and assessable online activities such as professional group panel discussions. With most students having already gained full-time employment and some even working in their profession, students were developing self-concept and self-schema in relation to their professional selves. Drawing on these and weaving them into learning were important in Tulula's website and assessment design. In their real professional world, Tulula considered that students could easily become isolated as early career professionals. It was important to Tulula to equip these students with tools, strategies, networks and a sense for how their university learning has a place in their day-to-day professional lives.

> The idea being to get them to think about the literature and the theory critically in terms of what they know about (the professional working environment) so that they'd get this idea, at the very point at which they're going off into the wide world as professionals, that the university information, knowledge, and resources actually has a place in getting them through their day to day lives in (their working environment).

Students had many choices about how they participated in the course and the professional issues they investigated. Using the inherent non-linear nature of the web allowed Tulula offered students a range of approximately 132 'adventure' options and various 'triggers' so that learners had 'choices, both in perception and in reality'. It also meant that 'the way that (students) learn is going to be matched one way or another, to their preferred learning style' and their sense of professional self.

Discussion

For each of the three award-winning teachers the relationship and collaborative effort of learners and teachers was essential to achieving the aims of learning and teaching. It was clear from their learning and teaching beliefs that, even with different roles, both the learner and teacher had responsibilities that influenced the outcomes of learning and teaching. For Kara as master craftsman the learner needs to be committed to learning as an apprentice from the teacher as disciplinary expert. For Jack learners and teachers had an equal participatory role and while the teacher was responsible for designing learning to enthuse learners and providing a stimulating and engaging learning experience, learners needed to partake in these opportunities as deep and active learners. For Tulula, the teacher as a collaborative partner in the co-creation of the learning experience, considered learner needs and interests in the selection of content, assessment and pedagogy, but ultimately the locus of control was with the learner. Tulula recognised the extent to which the self-schema, self concept, motivation, social interactions and the way they engaged in learning influenced the experience and achievements of learners.

All three teachers expressed the belief that web technologies were a tool for teachers to combine with their own knowledge or philosophy of learning and teaching to design for learning. They expressed the view that the use of web technologies needed to be driven by educational aims with consideration of their diverse range of learners rather than a 'build-and-they-will-come' approach. Kara stressed the need for both learners and teachers to be engaged in online learning and the opportunities afforded by web technologies for interaction, inclusiveness, socialisation and communication. Jack believed that web technologies could further enhance his lectures and tutorials by extending student engagement and stimulating better communication and deep and active learning in a safe virtual zone. Tulula also spoke of the opportunities around social interaction and communication when using web technologies and the culturally inclusive environment they can help create. She stressed the importance of good educational design so that students feel comfortable and motivated by the web environment and can see how the whole package fits together. Connectivity between learners, diverse resources and the teacher, was a clear benefit for Tulula and alluded to by both Kara and Jack.

In practice all three teachers made the educational aims for using the website explicit to their learners. Each provided a thorough learner orientation to the course website that included a rationale explaining why they had used the technology, and an explanation of how the technology was to be used on a regular basis with clear expectations of learner use. Each website showed evidence of clear guidance and scaffolding within activities and in relation to the whole course. Communication, socialisation and discussion-based tasks were a strong feature of all these learning designs. For Kara and Jack, their website designs engendered daily or weekly student participation and connectivity with their courses and learner communities. Web technologies also assisted Kara to provide a more equitable learning experience for her off-campus learners. In Tulula's case, the web provided her learners with options around how they participated whether they were on-campus or not. Learner interests, needs and motivation were considered in all three web designs. Kara's 'hooks' and authentic assessment tasks and Tulula's 'triggers', 'adventure options' and professional links stimulated learner engagement and interaction. Jack's weekly online activities motivated learners to experience disciplinary research and concepts that could be further explored in tutorials.

While these common themes emerged during data analysis it was also notable how some of the different participant beliefs influenced their design approaches. Kara conveyed that her view of learners and teachers was quite structured and formalised through the teacher-craftsman as expert – learner as apprentice model. Her beliefs about web technologies were focused on the attributes *the teacher* as the craftsman needed and how *the teacher* might design and provide guidance for learners. In practice Kara's site was designed so that expert knowledge was available in a structured format and her craftsman-like approach had a strong guiding presence in the social interactions with learners on the site. In contrast, Tulula put more emphasis on the learner, learner responsibilities and learner choices. She believed in learners and teachers as collaborative partners but expressed a firm belief that learners are ultimately responsible for their own learning and the creation of their knowledge. In expressing her beliefs about web technology, she stressed the need for appropriate educational design from the point of view of the learners (so that they don't feel directionless and powerless) and in terms of what comprises effective web learning. In practice, her site was very learner centred and offered learners many options and choices about how and what they learned with an emphasis on enabling the learner to transition to professional life. Jack's learning and teaching beliefs were centred around the teacher motivating and enthusing students to light their fire for learning. He also focused on equitable learner and teacher participation in active and deep process orientated learning. His web beliefs expressed his commitment to learners and learning over teachers or the technology itself and he believed that technology offered him different ways of stimulating learners to participate in deep and active learning. In practice he used his website to connect his learners more strongly and more frequently to their learning experience and to engage them more deeply with disciplinary research and concepts. In this way, the web technologies offered him an alternate and complementary way to enhance his face-to-face classes.

Conclusion and implications

There is yet much to learn about the influences of teachers' belief systems on their use of the web and other new and emerging learning technologies. As suggested in the pilot study (Steel, 2003), the data collection techniques of concept-mapping and stimulated recall were successful in eliciting rich and revealing data about the beliefs and practice of academics using the internet in their teaching practice.

Exploring the beliefs and practice of award-winning teachers with a relatively intricate and bountiful range of thinking about learning, teaching and web technologies revealed a variety of themes, beliefs and practices, a few of which are reported here. This paper demonstrates how differing belief propositions around learners and teachers, influenced the participants' approaches to designing and implementing their course websites. While some of these beliefs may be equally applicable to non-web-based learning environments, in all cases the web technologies afforded the enactment of these beliefs through the various tools they offered.

Specifically this study starts to shed some light on why it is necessary to also consider teacher beliefs about web technologies if we are to explore teacher practice in a web-based environment. In subsequent papers, I intend to further explore the claim made by Bates and Poole (2003, p.25), about the inter-relationship between our choice and use of technology and our beliefs about knowledge, teaching in our disciplinary context and the way students learn. It is hoped that this and further papers from this study will be usefully employed to inform academic development and practices around the use of web technologies in university learning and teaching.

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Pragmatic approach to learning materials

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An important yardstick by which any innovation may be judged is that of uptake by users. In the context of teaching and learning, innovative approaches do not necessarily need to involve a high level of technology. Indeed, there are robust arguments that support the use of tried and tested approaches and tools that are used in novel ways. Staff hesitancy to innovate may be alleviated if they do not need to be continually retrained (e.g. in the use of new software). An approach that is being adopted successfully at The University of Newcastle is the use of a customised Microsoft Word template as a course-authoring environment, which is distributed to students as PDF files via Blackboard or CD. This paper explores the challenges presented by this approach and contrasts these with the benefits that accrue. It provides evaluation of stage one of the University of Newcastle's Course Template pilot project, and discussion of the current work in progress on stage two of the project.

Keywords: templates, innovative teaching and learning approaches, learning design, case-studies, problem-based learning

Background

The University of Newcastle's Centre for Teaching and Learning is required to adapt to change swiftly, to be able to think innovatively with limited resources, and to meet clients' needs in a timely fashion. These demands are not unique to our centre, but are part of a wider current climate within higher education. We have seen a gradual move away from the development of time-consuming, resource-intensive, large-scale multi-media productions for individual academics, towards the development of small-scale generic reusable tools and templates for the wider university community. The current challenge is how best to:

- serve an academic population that is under considerable pressure to prove and improve the quality of Australian higher education (Stevens, 2005)
- cater to an increased focus on students' experiences and satisfaction at university (Scott, 2006), and
- deliver a worthy product.

The *UoN Course Template* has been developed specifically for academics designing individual courses ('course' is the nomenclature used at The University of Newcastle for a 'subject'). The template is flexible enough to be used for courses that echo the problem-based learning and case-based learning philosophies for which some schools at The University of Newcastle are renowned. The template has been designed to assist academics to rethink their course design and to move away from content-driven courses (Gibbs & Gosper, 2006); instead focusing on *learning tasks* and the *resources* students need to complete those tasks.

The subject of this paper came about in response to a number of requests by academics for a robust online template that requires no specialist software knowledge and minimal administrative support.

What is the UoN Course Template and what makes it special?

The *UoN Course Template* is a collection of MS Word documents that are linked together through a 'distribution system' to deliver scenarios to students via a CD, Learning Management System or the Internet.

Creating a template using MS Word is not a new concept. Many educational institutions delivering distance-learning materials have used MS Word templates for paper-based materials for some time. The idea of using a MS Word template in an online and interactive way is a more recent notion, and perhaps seen by many as a retrograde step, since website software such as Dreamweaver or desktop publishing software such as PageMaker or InDesign tend to be more obvious choices. The reason for choosing MS Word over other software programs was a pragmatic one: most academic staff have at least a basic understanding of this software, and most computers (both PC and Mac) have it installed for everyday tasks.

Our intention was to provide a template that was not resource intensive and that could be used with minimal induction and maintenance. We aim to enable academic staff to present professionally presented online material in a relatively short timeframe without a large initial investment of resources. There is much current debate about who should be responsible for the production of learning materials. Should it be the role of multi-media professionals or should academics do it themselves (Manto, 2006)? The authors of this paper join the debate in regard to acknowledging the fact that in the present knowledge economy, where much information is rapidly changing, simple solutions to updating online course materials expediently are sought by academics. The purpose of the *UoN Course Template* is to provide academics with a robust tool to achieve their task of course design without overwhelming the course development process unnecessarily.

The UoN course template design

Unlike a typical MS Word template, the *UoN Course Template* [http://www.newcastle.edu.au/service/teaching-learning/projects/templates/index.html] is in fact six separate templates. Two of the templates, ‘Main menu’ and ‘Getting started and Help’ require minimal modification, whilst the remaining four templates provide for users to add content and modify it accordingly, as outlined in Figure 1.

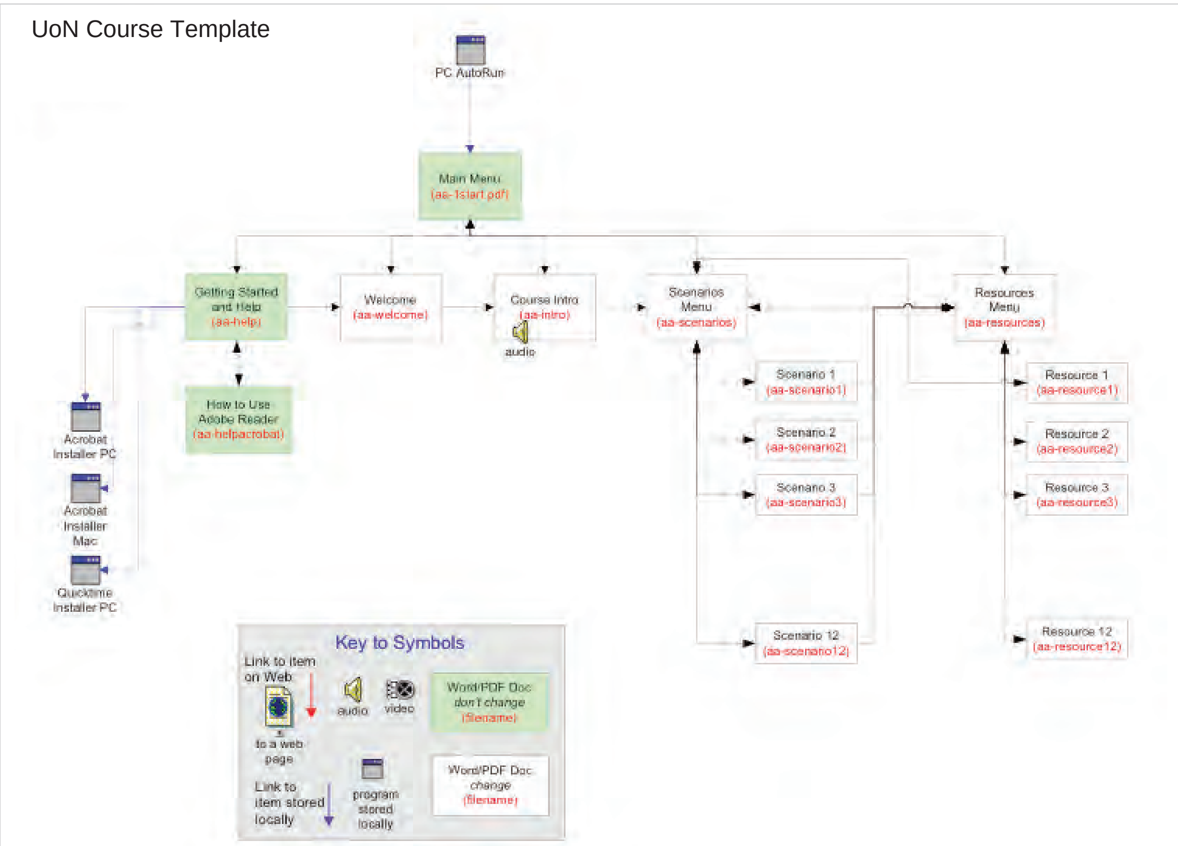

Figure 1: Interactivity flowchart

These templates provide the user with a toolbar menu of macro buttons to simplify the document formatting process.

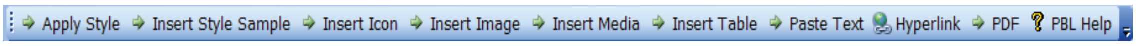

Figure 2: UoN course template toolbar

The template provides opportunities to insert a range of media, such as audio files, video clips and digital photographs, as well as the ability to hyperlink existing PDF files and relevant websites. Eleven engaging icons were designed to represent a wide array of learning tasks ranging from activities and case studies to web links.

Once users have modified the template MS Word files, each file is converted to PDF format using the conversion software Adobe Acrobat (this software is needed to convert the MS Word files). The group of PDF files are then distributed to students either through a LMS such as Blackboard, or via the Internet or CD. All of the templates are hyperlinked to the Main Menu and students navigate through these hyperlinks or the PDF reader navigation. Students need access to PDF reader software and to the Internet (depending on context) to access the materials.

Pilot project phase one

In the preliminary stages of the *UoN Course Template* project we encountered resistance from a number of our peers about the use of MS Word. In light of this perceived resistance the focus of the first stage of the evaluation of the template was on the end users: students at The University of Newcastle. We adopted the stance, supported by current research (Holland & Pithers, 2005; Scott ,2006), that interactive online material does not need to have all the 'bells and whistles' to enhance learning. Holland & Pithers (2005) and Scott (2006) noted that students were primarily interested in well-organised, contextualised and relevant learning activities and assessment tasks. The *UoN Course Template* was designed as one of the steps to support academics to achieve this outcome.

Construction ecology 1

This section describes the use of the *UoN Course Template* in a course entitled 'Construction Ecology 1'. by staff in the School of Architecture and Built Environment at the University of Newcastle, Australia. The School comprises three disciplines: Architecture, Construction Management and Industrial Design. A reorganisation and redevelopment of courses has recently occurred, with discipline-centred delivery of similar material being replaced by delivery to combined cohorts of students. An added dimension to these developments is a move to incorporate distance learning Construction Management students with on-campus students in mixed-mode delivery from Semester One, 2007.

The Construction Ecology 1 course is delivered to a joint first year cohort of Architecture and Construction Management students, as well as to a small number of students from other disciplines who select the course as their elective. The introductory nature of the course is reflected in the objectives it seeks to deliver; i.e. students are able to:

- employ appropriate terminology to describe materials and their properties
- define materials properties and their design considerations
- describe the influence atomic bonding systems have on materials properties
- use appropriate classification systems for categorising materials utilised in construction
- acknowledge the environmental implications of materials and their manufacture
- make informed decisions on the application of materials to defined design situations
- identify a range of commonly used construction materials and describe the rationale for their application
- describe the manufacturing processes which provide the predominant construction materials
- describe the impact of utilising multiple materials in combination.

The course adopts elements of problem-based learning. Students are provided with a number of ‘real-life’ scenarios and are required to recommend construction materials suitable for the different conditions / purposes inherent in each scenario. They work in tutorial groups to identify the requirements of each scenario and criteria by which materials may be evaluated. Each student then prepares a portfolio that documents their rationale in recommending certain materials, and sets out the properties of those materials.

In preparation for the move to mixed-mode delivery in 2007, a prime objective for development of the course was that the adopted approach should simultaneously accommodate on-campus as well as off-campus delivery. In light of the large file size of the resources provided, and recognising that some students have only poor Internet access speeds available at home (whilst some work on construction sites with none at all), it was decided to make the material available to students on CD. The students still needed Internet access for a number of hyperlinks to read relevant information, but not for downloading large amounts of material.

Method of student evaluation

Sample

The 106 students studying the Construction Ecology 1 course received an online course evaluation questionnaire. This group of first year undergraduates is a diverse group in age where some are straight from high school (late teens) whilst others have come through the TAFE system and are working in their field (21–35+). The majority of the cohort are male.

Instrument and procedure

The questionnaire comprised 35 questions, covering eight topic areas. The topics included course content, course design and course assessment, as well as the course template design and accessibility, and technology access. Ten of the 35 questions dealt specifically with the *UoN Course Template*. The present authors created the questionnaire by examining a number of examples found in relevant research publications and by conferring with peers on exemplar models. 85 responses were received out of the class of 106 (a response rate of 80%).

Results

The following are some of the key points raised:

- 86% of students agreed or strongly agreed with the statement “Using the CD [via the *UoN Course Template*] was a good way for me to access the course content”
- 84% of students agreed or strongly agreed with the statement “The CD was easy to open and use”
- 81% of students agreed or strongly agreed with the statement “The instructions provided were easy to read and were useful”
- 56% of students agreed or strongly agreed with the statement “It was easy to move from page-to-page and link-to-link”, whilst 20% disagreed or strongly disagreed (8% were unanswered, 16 % were neutral)
- 79% of students agreed or strongly agreed with the statement “The hyperlinks helped me engage actively with the course material”
- 79% of students agreed or strongly agreed with the statement “The navigation links were self-explanatory and easy to use”
- The majority of students accessed the CD at home (79%), whilst only 14% used it at University (7% of students didn’t answer this question)
- 80% of students did not experience any technical problems using the CD, whilst 8% said the experienced problems ‘sometimes’ and 5% had experienced problems (7% of students didn’t answer this question).

Students also provided detailed responses in answer to various questions. When asked to identify what was most valuable about the course, ten students specifically identified the CD, and several others made reference to it by implication. For example, one student stated that "Lecture notes accompanied by CD and BlackBoard notes provided good information… these sources helped in finding information, as well as incorporating material properties into achieving a desired outcome."

Discussion

Students were overwhelmingly positive about the CD and template (and the problem-based approach the course adopted). They found it easy to use, convenient and relevant. Few experienced technical problems. One aspect does warrant further development: that of navigation between hyper-linked PDF documents. This will be addressed in future versions of the UoN Course Template.

One of the unintended outcomes of the creation of the template has been the opportunity to provide academics with professional development opportunities about learning design and to provide models that benchmark learning design, as well as to address some specific flexible learning quality issues such as consistency and quality course design as outlined in the Carrick report *Promoting and Advancing Learning and Teaching in Higher Education: The Messages from the AUQA Report*. Through our induction workshops a number of issues arose which demonstrated that more models of good learning design needed to be made available to academics. The *UoN Course Template* induction manual will provide such models and will direct staff to good practice through a number of useful websites (AUTC 2001) and documented research in this area (Brown, 2006). There will be further professional development on course design for multiple modes of delivery using the *UoN Course Template* which will look further at primary users of the template and how the template can support them in rethinking learning through the use of the *UoN Course Template*.

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Computer-mediated interaction in context

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This paper reports research into the impact of computer-mediated interaction on both students and tutors in the context of a course-specific case study. Quantitative data provided evidence of successful achievement of learning outcomes and high student completion rates. Tutors identified interaction as one in a number of successful features in the course design, about which they were very positive, inspite of the increased workload it entailed. Exploration of student data revealed both positive and some unintended negative effects associated with a highly interactive and activity-led approach to learning. These findings emphasise the importance of the context for interaction, in terms of the effective combination of both content and interpersonal interaction, the strong link with assessment and the content and design of activities. Tutors and students reported high levels of enjoyment and engagement as key features sustaining the success of a stimulating pedagogy.

Keywords: interaction, computer-mediated communication, activity design, distance education

Introduction

Interaction is seen as essential in conceptual learning, because it enables the learner to build personal understanding, through a two-way, 'conversational' learning process (Laurillard, 2002). Bannan-Ritland refers to it as "a critical variable in learning" (2002, p. 161). The rationale for interaction relates to both cognitive and affective aspects of learning. Learners need to articulate their understanding and have personal feedback that enables them to adjust and to develop their understanding. They also need the opportunity to influence how learning proceeds, through being able to interact with their teachers. The key role of interaction from a social constructivist perspective therefore suggests that the design of learning environments should promote interaction, and that new information and communication technologies (ICT) should be developed particularly to provide more interactive learning experiences (ESRC, 2002).

Within distance education, interaction has been recognised as a diverse phenomenon, open to different categorisations. Hirumi (2002) places Moore's initial distinction between content and interpersonal interaction (Moore, 1989) within a more comprehensive framework which includes learner-self interaction, learner-human interaction, learner-non-human interaction and learner-instruction interaction. This framework offers a useful analytical tool for the analysis of planned interactions of many kinds. However, Bannan-Ritland (2002) asserts that interpersonal interaction has dominated the literature. Furthermore, two issues are prominent within this literature: the often low rates of contribution to conferences by learners, and the quality of dialogue and discussion, which may fall short of the levels of argument or knowledge construction desired (Salmon, 2000). Gorsky, Caspi and Tuvi-Arad (2004, p.1), for example, report that learners only chose to interact when they could not solve difficult problems on a compulsory chemistry course, as 'It was found that all students initially chose individual study characterized by intrapersonal dialogue'. Other researchers focus on analysis of the quality of discourse (Hakkinen & Jarvela, 2006), which may revolve round information exchange rather than more challenging forms of argument and knowledge construction. McAlister, Ravenscroft and Scanlon (2004) for example, review the use of interaction as a means for collaborative argumentation using online educational dialogues. They suggest that structuring interaction is essential, both at the macro level in terms of activity design, and at the micro level in terms of roles and procedures that ensure learners engage in reasoning, use evidence appropriately and develop argumentation skills. They also emphasise that learners' motivation cannot be assumed, particularly in distance education, where a context needs to be created that will "cultivate the social, motivational and empathic features that support meaningful and effective interaction" (McAlister et al., 2004, p. 195).

The achievement of effective interaction thus presents a considerable challenge to the course designer. Within distance education, interaction must also help retain students and support the achievement of learning outcomes. Research that provides evidence of the impact of specific designs for interaction is necessary if we are to build knowledge about how learners respond in real study situations. Research at the Open University, funded by the Andrew W. Mellon Foundation, explored the impact of computer-mediated interaction, and one of the case studies from the research is presented here to explore the intersection between interactive course design, learning outcomes and learner and tutor experience.

Research methods

Study of the research literature has identified the multidimensional nature of interaction, and the complexity of the context of use. Different types of interaction can be mediated by a range of different activities in courses, thus influencing the quality of the outcome and impacting on students' experiences of the study process. Accordingly, detailed study of particular cases of interaction was a key element in the research strategy. As Schofield (1993) argues, qualitative research is interested in generalisability not through statistical sampling in order to generalise to the larger population, but through a rich description of cases that enables comparability with other settings to be assessed and findings interpreted in terms of their relevance for different contexts and cases. This raises the question of selection of cases and we were able to use a principled approach for this, avoiding the tendency of some qualitative researchers to select cases "on the basis of convenience or ease of access" (Schofield, 1993, p. 209). Courses were selected on the basis of the extent to which they offered either interpersonal or content interaction, or both. They were also reviewed in relation to the degree to which such interaction was integrated into the course learning outcomes and their assessment. Integration has been identified as an important factor in whether or not students engage with the computer-mediated elements in their course (Kirkwood & Price, 2005) and this provides an important indicator of the pedagogical context in which interaction is used. Thirty-six courses were identified using the two dimensions of interaction and degree of integration, and this paper reports the detailed study of one course from this sample, titled *The Environmental Web*. The case study course includes extensive opportunities for interaction with both content and other learners, and integrates interaction very strongly into the learning outcomes and their assessment. While this course presents a unique context, it was selected because of features that enable it to be compared with other courses and a basis for interpreting the significance of the findings.

The research strategy also used quantitative data to enable comparisons to be made in relation to student retention and quality measures. A sample of students on the thirty-six courses completed the Course Experience Questionnaire (Ramsden, 1991) for example, and their evaluations of course quality were compared. Yin's approach to the design of case study research emphasises the need to develop theory (referring to propositions made on the basis of both empirical analysis and experience, as well as of the research literature) at the design stage of case study research (Yin, 2003). Accordingly, a number of 'theoretical' propositions were identified before data collection:

- Students' experience of computer-mediated interaction will have a positive impact on their learning;
- Take-up of opportunities for interaction will be influenced by their integration within the course design, notably its assessment;
- Students' perceptions of the quality of their course will be influenced by their experience of the interaction it provides.

Also following Yin, research questions were identified, on the basis of these theoretical assumptions and the aims of the broader research project, and these are as follows:

- How does the interaction experienced by students impact on them in terms of (a) their experience of study (enjoyment, interest, study time, workload, persistence etc); (b) their success in meeting assessment requirements; and (c) their interest in registering for further study on courses including interactive learning experiences?
- How does interactive study experience impact upon the perceptions, workload and experiences of tutors on the course?

Data on student retention and performance, quantitative data from a survey carried out on a random sample of students in 2004 and interviews with tutors and students were used to explore these questions.

A case study in interactive pedagogy

The course *The Environmental Web* was selected as a case study because it offers a computer-mediated interactive study experience that is strongly integrated into the assessment and study process. The course recruits about 420 students annually, is mandatory within the Open University Environmental Science degree, is at third level and accounts for 60 points, and the equivalent of half a full-time year's study. It was selected based on evidence about key features of the teaching approach, outlined below.

Structured and assessed use of computer-mediated communication (CMC)

Students are required to participate in asynchronous tutor-group conferences from week 3 of the course and tutors ensure that all students log on from week 1. Study of the course is led by online activities which feed forward into online discussion designed to achieve a specific task. For example, the first group conference requires students (up to 30 in each tutor group) to role play a meeting of the Association of Small Island States (AOSIS), to agree on a series of demands to the United Nations, for actions in the area of policy and aid to address the impact of climate change on small islands. Before this collaborative activity, tutors allocate one of the small island states to each student in their group. Students work independently to collect data on 'their' island from external websites and submit it in tabular form to a conference set up by the tutor. Students also submit a review of the vulnerabilities and needs of their own island, plus suggestions for collective demands, prior to the discussion. The first assignment for the course then requires students to write a brief review of the discussion and their role in it. A list of the agreed demands is submitted together with an account of how the consensus was reached, or in some cases, failed to be reached. Twenty percent of the marks are allocated for this and a further 15% for use of data about their island that supports some aspect of the demands agreed. A later group discussion on biodiversity protection forms the basis for part of the text submitted for the second assignment, accounting for 30% of the marks. National and tutor group conferences continue to the end of the course on specific topics, though without being formally assessed.

Web-based activities with feedback, lead the study process

The course is organised in four blocks, each of which has approximately 10 online activities undertaken by students independently, accounting for approximately half the course study time. Students learn how to search environmental science websites, to evaluate the information they find, and to use it for analysis and problem solving. They also undertake field observation of specific types of birds, dragonflies and woodlice in their area, and submit their data to the course biodiversity database, which displays the data in geographically referenced form. This and many other activities are the basis for graded assignment tasks. Students also receive automated feedback as they work through the online activities.

Computer models and tools play a central role

Two climate models are included on CD-ROM and students use these to investigate the relationship between carbon-dioxide emissions and mean surface temperature increases. The impact on different countries of strategies for sharing the reduction of greenhouse gas emissions is also evaluated using a climate model. Students also carry out an independent project on a topic of their choice, submitting their reports as Web pages constructed using a supplied tool, The Web Wizard. This project report replaces the end of course examination.

These features of the course require students to interact both with their peers and with computer-mediated information, resources and tools. The course focus is described by the chair: 'Our overall aim is to provide you with the skills needed to develop your own environmental literacy and to take part in informed environmental debate and action, rather than to expand your environmental knowledge as such.'(Open University, 2006). A pedagogy of active involvement and participation alongside other practitioners in the environmental arena is delivered through a variety of forms of interaction, and the aim of the research was to explore student and tutor experiences and perceptions of this.

Quantitative data

Student performance data for *The Environmental Web* are very positive. A high proportion of students complete the assessment requirements of the course, reviewing the data since the first year of the course in 2003. Table 1 shows that the course is around 10% better than the average for all level 3 courses in the Science faculty and marginally higher than the level 3 average in the Social Science Faculty in two out of three years. The only other Science courses to achieve higher rates of completion are all residential school courses.

Table 1: Rates of completion compared with faculty averages from Science and Social Science

Course(s) base for calculation % of students * who complete	**2003**	**2004**	**2005**
The Environmental Web	78.6	74.0	77.6
Science Faculty Average for all Level 3 courses	69.2	68.5	66.5
Social Science Faculty Average for all Level 3 courses	76.4	77.3	76.5

Note. * Total numbers for % calculation are as in the returns to the UK Higher Education Funding Council.

A survey carried out in 2004 (response rate 47 %) provided data on 36 courses using computer-mediated interaction, including *The Environmental Web*. The survey used an adapted version of Ramsden's Course Experience Questionnaire (Ramsden, 1991), containing 36 questions generating seven scales: appropriate assessment, appropriate workload, clear goals and standards, emphasis on independence, good materials, good tutoring and generic skills. Student responses were highly positive in relation to appropriate assessment and generic skills, with highly ranked scores on items shown in table 2 (where 1 equals 'strongly disagree and 5 equals 'strongly agree').

Table 2: Positive response on items from the Course Experience Questionnaire

Items from the CEQ	**Score, TEW***	**Median score+**	**Rank 1=best**
Helped me develop problem solving skills	3.8	3.6	6
Helped my ability to work as a team member	3.4	2.1	4
Has sharpened my analytic skills	3.8	3.8	13
To do well on this course all you need is a good memory	1.5	1.9	1
More confident about tackling unfamiliar problems	3.6	3.3	8
the course was more to do with testing memory than understanding	1.4	1.9	2
Helped me to develop the ability to plan my own work	3.6	3.6	11
This course really tries to get the best out of all students	3.9	3.7	8

Note. * The Environmental Web; + based on 36 courses surveyed.

Students' responses showed that the course successfully requires them to apply understanding in completing the assignments and to develop higher level skills, in particular problem solving and team work. However, there was strong agreement (above average) with the statements 'The workload on this course is 'too heavy' and 'there is a lot of pressure on you as a student' and disagreement with the statement 'students are generally given enough time to understand things they have to learn'. Students also did not agree with the statement that 'students have a great deal of choice over how to go about learning' (at 2.3 this was the lowest score of any course included in the survey). Finally responses also indicated that students did not find the aims and objectives and standards of work clear enough. Therefore these findings constitute a mixed picture. The course undeniably meets the most demanding test in terms of retention and successful completion of assessment requirements. However, qualitative research was undertaken to explore in more depth the nature of the impact of computer-mediated interaction on the course and also what might lie behind the mixed response from students.

The students' perspective

Students who were surveyed in 2004 were asked to comment on the advantages and disadvantages for them of interactive ICT elements used in their course. Conferencing in particular offered both clear benefits and, for some students, equally clear disadvantages. Benefits were identified as broadening one's views by reading a range of student opinions and experience, finding help with difficult areas of the course, sharing information and learning from more experienced peers.

> The ability to assess different points of view greatly helped. I have on one occasion changed my opinion, when new facts were brought to light by another student. We all have access to, or have discovered different relevant material. We share this information.
>
> Motivation to study when other people in same position (i.e. busy lives and too much study!). Sharing ideas and learning from other people with different skills. A sense of being part of a team.
>
> For those of us who did participate regularly it was a good forum for expressing an opinion on important issues. It was interesting to obtain different perspectives than my own. Changed the way I looked at certain issues.
>
> It has improved my confidence tremendously and been extremely motivating for me.
>
> Allows discussion between students which is not always possible on other courses. You 'get to know' the other students especially those in your tutor group and can help each other out.

However, the disadvantages for some students were that conferencing brought extra deadlines and time pressures; it also added to the 'parallel processing' design of the course, where students have several activities to manage concurrently. This comment sums up the clash between study demands and lifestyle:

> Enjoying the course in a masochistic way – finding it a very heavy workload but find the biggest drawback is not being able to tailor my studies to fit in with other 'life events' – so many deadlines/conferences etc to meet all the time adds quite a bit of pressure.

Students perceived contradictions between what the many interactions entailed, and 'the flexible ethos of OU study'. They had developed modes of study that they felt the course frustrated – 'having to do specific tasks at specified times can get in the way of trying to get ahead'. Another student commented that she would not recommend the course 'for people who like me have family and work, and do the majority of their study by reading through a text and making notes as they go'. She did not find the course 'either 'portable' or convenient'. For some students, stress was the result:

> I am finding this the most stressful and time-consuming course I have yet done. There seems to be no point at which one can feel 'I have finished that section, good, take a breather and then set off on the next section. There are always at least three, sometimes five different activities to be done/ongoing at the same time.

In 2005, volunteers who had completed the course were requested to respond to an email proforma of seven open-ended questions about their experience. The aim was to explore some of the more negative responses identified in the questionnaire results outlined above. Ten students responded to the proforma and generally concurred with these comments on the time pressures and parallel processing of different activities and deadlines. These workload pressures also reached a peak during the summer, when many students have added pressure from trying to find time to take annual holiday. However, students were also asked more general questions about how *The Environmental Web* differs from other OU courses they had taken, and their responses provide evidence of highly integrated forms of interaction, with some unease about the interface interaction of extensive computer-based study:

> I have never been so tied to a computer for any other course (Student 1).
>
> It is one of only two courses I've done…where constant communication with tutor and other students is VITAL. The other courses I've done in more isolated circumstances…and I don't think I've suffered too much on those, but *The Environmental Web* would be impossible (Student 6).

> At level 3 this course built a much better relationship with the tutor than previous level 3 courses I have taken. However it also requires you to have constant access to the Internet and so can be limiting (Student 10).

Three students commented on the increased contact with tutors, and this theme also developed when students were asked what they thought the strengths of the course were. Students commented on the skills they had learned, the high interest and currency of the course content, and the interaction with other students as well as the tutor:

> The single greatest strength of the course was that it taught me how to search the web far more effectively than I was doing previously (Student 3).

> The course felt very current both in content and in the way students were expected to learn I guess because man's impact on the environment is big news…and also use of the internet, eTMA, WebWizard and much online conferencing (Student 4).

> The much greater level of interaction with other students and tutor. The requirement to do your own research for lots of things is a valuable learning experience (Student 6).

Praise for tutors demonstrated the vital role of electronic communication in enabling tutorial intervention, effective feedback and support. These students reported much more effective "teaching presence" (Rourke, Anderson & Garrison, 2001, p. 3) because of CMC by comparison with face-to-face and written communication:

> (Tutor X) was a great tutor, friendly, supportive, encouraging... Emails were answered promptly…comments on (assignments) were relevant and helpful, also because typed – could read them – unlike any other tutor before (Student 2).

> I did not miss the face to face tutorials. Tutor provided direction by conference posting and duplicated to personal mailboxes where important – I always felt my tutor would be there to help if needed (Student 4).

Tutors had identified the start of the course as critical to its success, and telephone interviews were undertaken with three students during April 2006, covering their experience to that point, including the AOSIS activity (see above). All logged on daily, and had found the workload at the beginning of the course high but manageable. One student said the workload was heavy and was asked why even so, she did not feel under pressure. Her response was to emphasise the enjoyment of the study process: "…I think it's the fact that it's not boring. I mean you don't have to do work from the book all the time and it just is this combination, this change from one type of activity to another."

All three were enjoying the course and had participated actively in the AOSIS conference role play. All were asked whether it had been possible to express differences of view or opinion, since previous research suggests students tend to avoid argumentation (McAlister et al., 2004). The role play mechanism appears to have had the positive effect of enabling students to express their views directly. The phased activity design meant that they had researched the vulnerabilities of their island before conferencing, and were aware of what might or might not be in their island's interests.

> Interviewer: Did you find it possible to disagree?

> Student: Oh very much so – people did disagree a lot and managed to put forward their points of view a lot, which I really liked, and backed it up with examples…most people's decisions were informed and you could see that.

This student confirms that students used evidence to support their views and the quality of engagement in the dialogue was a reflection of genuine engagement with the needs of their island. The group had to reach a consensus and took the initiative to use a spreadsheet to plot their views. This shows evidence of self-organisation in a context where the group were clear about their task and not dependent on tutor facilitation. It was also possible to disagree with a majority view where that clashed with what was in the interests of the island that a student was representing:

> About half way through we put everything on a spread sheet to see what kind of opinions were coming forward, and it was quite clear that three issues were coming forward from most people, so you…thought …if you weren't in that consensus you would be in a minority and probably you'd have more sway if you felt able to join the majority…on most of the issues I could but there was one or two issues where I said no there's no way I'm going to compromise on that…I was Haiti, so I was very poor…there was a lot of wealthy islands, so some people didn't have the issues that Haiti did so there was some things that I just couldn't compromise on.

A second student identified the role play activity as key to being able to interact without knowing the group or having met them in advance. The task enabled students to "project themselves socially and emotionally" (Rourke et al., 2001, p. 3) and to make effective contributions from the beginning, without relying primarily on the skills of a facilitator:

> Interviewer: So did you find it difficult to contribute…because you hadn't met these people first?
>
> Student: No no not at all. Because in there we had an aim, we had a target so I didn't mind at all that I did not know the fellow students. We just exchanged views...

The third student worked in a group that agreed to work online on a selected date, to improve the process of reaching consensus – another sign of self-organisation. She also described a process of reasoned debate where views could be changed:

> Student: …We had a discussion about tourism…and that was one of the points that we'd agreed on the Sunday and then after some more of the comments the following week it was changed to not stopping tourism at all but going for eco-tourism and going for high taxes on air flights…so that opened up a separate debate in that area and that was one of the things that we altered the opinion on.

The phased design of the activity motivated students to engage with the evidence before interacting and the role play freed them from unease in putting forward and justifying their positions – they argued for 'their' island, not for themselves. The design of an effective context with phased stages and micro-level role structure supported online argumentation that engaged students and supported conceptual learning (McAlister et al, 2004). Students were also asked whether they would choose a similar course again, where there are no face to face tutorials but conferencing, as in this case. All three students were entirely comfortable with this mode of study and would not be put off from choosing such a course in future. However two still expressed a preference for face to face tutorials, inspite of feeling well supported by regular online interaction.

The tutor perspective

Five tutors based in three regions (out of thirteen) were interviewed in January 2005. A semi-structured schedule was used, interviews were recorded and transcribed, with tutor agreement on the text. A grounded approach was used in the analysis (Strauss, 1987), with detailed study of each transcript and building of rich connections between the perceptions communicated in each interview. The strategy was not to assume that computer-mediated interaction was the most important feature of the course, but to explore tutor perceptions in order to find out how they perceived the important issues. Accordingly tutors were first asked what made the course distinctive, from their perspective. Four themes were agreed on by at least two tutors; the skills students learn, the up to date nature of the course, the amount of interaction and contact with students and the innovative nature of the design. Interaction therefore was part of a broader picture emphasising course content and use of the Web, as well as the delivery of more contact as a direct product of interaction. Quotations from tutors reveal how interconnected these themes are. The topical nature of the course, its being up to date and innovative, are apparently as important as the fact of an interactive mode of study:

> I think very much the use of the Internet as, not so much a teaching tool, but as fundamental to the entire course. ..it's more than just use of the Internet as a medium of teaching, it's using it as the core of the course, teaching everything up to date and so on... It's use of the Internet to keep it up to date that is the key' (Tutor 4).

> The fact that it deals with issues that are very topical… it's the uncertainty when you're trying to make the politicians or whoever make these critical decisions that affect everybody's lives…that's what stands out for me' (Tutor 3).

Both these tutors are primarily valuing the fact that the course deals with issues of the day, as they appear on the day – literally since students use external Web Sites throughout for study data and resources. Other tutors focused on the skills students learn and in particular, the ability to evaluate information gleaned from searching the Web:

> This is one aspect that [*The Environmental Web]* teaches really well I feel…most of us teach other courses or teach in mainstream education, we're always pushing this point…with *[The Environmental Web]* right from the beginning one of the first activities they do is evaluating websites …So there's actually a very structured set of criteria that they'll look at in terms of looking at what is a good website for whatever purpose they're using it for and what isn't and I think that's invaluable… (Tutor 1).

Two tutors also commented on the increased contact that they had with students by comparison with other OU courses, one tutor comparing it favourably with A level (the final UK school examination at 18 qualifying for university entry) and explaining that he preferred the kind of teaching it enabled:

> It feels more like – how can I put it – more like genuine teaching... I have a lot more contact with students…compared with (another OU course) it's much more like the level of contact that you would expect at A level… I check my conferences more or less on a daily basis and there's usually something there….a more continuous form of contact. I can float things that I don't normally do... You don't normally float an idea, wait for a response from someone…the level of interaction is much higher…much more enjoyable. Certainly the students say that to me and I find it much more enjoyable (Tutor 3).

Another tutor referred to the study process using the interactive online activities, as more effective for learning, because of the continued feedback on progress: "What's distinctive about it is the way that you work through the material. You've always got questions and answers…the fact that you've got instant feedback when you work through the material" (Tutor 2). Tutors were also asked a second open-ended question, namely to identify whether particular aspects of the course teaching were key to its success. All tutors picked out aspects associated with interpersonal interaction, with three tutors commenting on the conferencing, the high rate of participation and continuity of student contact with peers as well as the tutor. Three tutors also highlighted the beginning of the course as key to its success. The first six weeks of the course focus on the AOSIS activities and culminate in a day school. Students are not given a choice, they must complete the activities and conference with peers if they want to submit the first assignment. Tutors say that this gets students involved right from the start and ensures that they engage with each other and the course. The data collection activities later in the course also sustain student interaction and, as importantly, engage their imagination, as this tutor indicates:

> ...the sort of study...where they count woodlice and things like that. They feel most of them very much part of a bigger whole, it's all very immediate, it's real research, it's actually useful for the scientific community and there are people all over the country feeding into this and that combines the immediacy of the style of the course with something which for many of them it captures their imagination, although they do complain a bit about sitting outside and not finding any dragonflies for example' (Tutor 4).

Tutors were asked whether students are effectively supported and all responded unhesitatingly that students are much better supported on *The Environmental Web* than other courses they tutored. The support comes as much from other students, they felt, as from tutors, with accessibility to online help being available at most times of the day and evening. All tutors logged on daily and commented that the workload was more continuous – and somewhat higher – than on a course without successful computer-mediated interaction. None of the tutors was negative about this, one even saying that it was 'addictive'.

> I suppose the biggest thing is being there all the time. I know they say oh you only have to look three times a week and you have to wait and that, so you don't - you get hooked on it cos you look every night most of the time you are at home. So if you want to go away, it's quite tricky...Oh, it has impacted on me. I learned a lot more about ICT...I like it, its addictive... you keep going back there to see what's going on, its um a sort of February to October junkie input kind of thing you know (Tutor 5).

All tutors also commented that the course provides a form of indirect continuing professional development, in that they continue to improve their own teaching skills for this interactive mode of study, and they also keep up to date with their subject:

> …I think what's surprised me is how much I've enjoyed it as a teaching medium and how much ... students are getting out of it as a learning medium. I really enjoy it. The interesting thing from my point of view is that with other courses I've tutored is that after you've done it just one or two years you get used to doing the same thing and you don't have to read the course materials because you know what's there...With this one I just feel that I'm learning all the time which is great…each time the course is presented I still feel I'm learning a lot about teaching in this way (Tutor 1).

Discussion

The design of a course selected as a case study of integrated computer-mediated interaction provided a highly structured context which successfully engaged students and supported their achievement of key skills and assessment goals, notably problem solving, team work and tackling unfamiliar problems. Interaction did have a positive impact on learning, particularly associated with the strong integration of interactive activities with assessment tasks. Students reported the personal impact of interaction in terms of feeling both less isolated and more aware of a broad range of views, valuing these new opportunities to learn from different perspectives and more experienced peers. Student experience confirmed the success of the structured activities at the beginning of the course, and the effectiveness of online role play in supporting reasoned argument and constructive difference of opinion. This was achieved through the design of activity and did not depend primarily on the skills of a moderator or facilitator, which previous research has emphasised (Salmon, 2000). However, the integration of interaction into the assessment process meant that students had to engage in conferencing and also had to manage activities running in parallel. The number of deadlines increased and some students reported that the course was more than usually difficult to manage alongside their other responsibilities. Some students also focused on computer interface interaction and experienced being tied to the computer as a study restriction. Students' assessment of course quality was negatively affected by these unintended negative impacts of an effective pedagogical design. However, the course achieved higher rates of completion than comparable courses in two faculties and students rated it highly for appropriate assessment and generic skills learning outcomes.

The tutor perspective was extremely positive, and gave equal weight to effective skills teaching and use of the Web for updating, as well as the interactive features of the course. Interaction was valued primarily in terms of the high level of interpersonal contact it delivered, and for the active study process created by online activities. Students were also seen to be much better supported than on other OU courses, even though there were no regular face to face tutorials. These features were seen as key to the success of the teaching, particularly at the beginning of the course. Tutors found the course enjoyable, as did their students, and this appeared to mitigate the fact that conferencing in particular increased their workload and also made it more continuous. Tutors also felt that they continued to learn from the course, as a highly innovative form of teaching, alive to change as it occurs, in environmental science.

Conclusion

Meeting the twin challenges of mobilising participation and high quality learning requires more than the design of interaction at the micro level of dialogue strategies and supports for argumentation and conceptual conflict. The evidence from this case study affirms that these are important, and that a well-designed role play activity can generate effective learning dialogues, even without some of the more elaborate dialogue support interfaces (Cook, 2002). But it also shows that interpersonal interaction was successful in part because preceded and supported by content interaction. The two worked together synergistically, and were consolidated by being assessed. The wider context of the course as a whole also shaped students' reactions and willingness to engage. It was difficult to separate out the positive impact of interaction from other aspects of the course pedagogy such as the currency of the content, the immediacy of its style and the role students are given as environmental researchers in their own right. A context was created that motivated students and gave them intrinsic rewards for engagement, as well as extrinsic rewards through assessment. This suggests that simply adding interactive features to a course is unlikely to lead to such positive outcomes.

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Podcasting, student learning and expectations

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This paper presents preliminary results of a trial of podcasting in six law units involving 1244 students during semester 1, 2006. The data revealed a rapid uptake and acceptance of podcasting with few difficulties. The vast majority of students perceived podcasting as having excellent value, particularly lectures and to a lesser extent, tutorials. Podcasting altered study habits, with students spending more time reading primary materials, and a minority of students spending time transcribing podcasts. Podcasts did not reduce participation on WebCT discussion forums. Podcasts were expected by students to be delivered within three days, with students prepared to accept lengthier downloads for improved quality. The paper discusses the main advantages and disadvantages of podcasting as revealed by student users. There is no doubt that audio podcasting has now become an essential requirement for teaching tertiary students within the law units. The challenge will be for UNE to create workflows to meet the expectations of students as to quality and service delivery.

Keywords: podcast, online learning, mLearning

Introduction

This paper presents preliminary results of a trial of podcasting in six law subjects involving 1244 tertiary law and business students during semester 1, 2006. Law subjects were chosen due to the tradition of oral delivery being the primary teaching method. The study is significant in its examination of student expectations as to delivery of podcasts and how podcasting impacts on student learning and study patterns. Podcasting is discussed in the theoretical context of digital natives engaged in mLearning. A qualitative mixed-method design was implemented to document, in the first instance, student experiences with podcasting as a guide for curriculum designers interested in implementing podcasting.

Background to the study

Laurillard (2002) stated in her seminal work *Rethinking University Teaching*, that it has long been recognized by academics that “students do not transfer their knowledge across different settings, that they often find it difficult to relate the theory to practice, that knowledge does seem to be context-dependent” (p.13). She goes further to point out that:

> if academic learning is not just about imparting knowledge, is it really different from the acquisition of everyday knowledge? We learn a great deal about the world very successfully without academic institutions, and with no help from any didactic process (Laurillard, 2002, p.12).

This discussion has at its focus the value represented by podcasting with a large cohort of students. The intrinsic case that is described highlights the need to understand fully how new technologies such as podcasting are able to assist students in their studies. The questions raised by the authors in this consideration are directly related to Laurillard’s (2002) discussion of everyday knowledge and how learning occurs for students. If this argument is taken a step further and we locate learning within the world of the student, then ignoring the opportunities for mLearning (mobile learning) will be to the detriment of current university teaching and learning practices. This wild claim is a brave attempt to negotiate the world that our students inhabit in what Prensky (2001) claims is “the arrival and rapid dissemination of digital technology in the last decades of the 20TH century” (p.1). Further that:

> Today's students – K through college – represent the first generations to grow up with this new technology. They have spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age. Today's average college grads have spent less than 5,000 hours of their lives reading, but over 10,000 hours playing video games (not to mention 20,000 hours watching TV). Computer games, email, the Internet, cell phones and instant messaging are integral parts of their lives (Prensky, 2001, p.1).

This presents for the teacher both an extraordinary challenge but also fortuitous opportunities. This generation have been tagged by Prensky (2001) as 'digital natives', as they "are all 'native speakers' of the digital language of computers, video games and the Internet" (p.1). His argument is persuasive, as he notes that these students are different from those of the previous generations, perhaps even our own, as they are used to instantaneity and "they've been networked most or all of their lives. They have little patience for lectures, step-by-step logic and "tell-test" instruction" (p.2). For the teacher this presents a dilemma in how to assist these students in their learning, and requires a reassessment of the methodology and content of what is learned. As Bull (2005) states:

> MP3 players such as the Apple iPod have become the mechanism for distribution of music for today's youth just as the CD and vinyl records filled this role for previous generations. Educational uses of podcasting build on the foundation of this cultural phenomenon (p.25).

If we return to the opening of this paragraph this presents both challenge and opportunity. Further, if we highlight Laurillard's observation of everyday knowledge, there seems to be some congruency in taking stock of the context of our learners in order to best meet learning opportunities.

Podcasting

Essentially podcasting is a method of distributing multimedia files that is distinguished by its ability for them "to be downloaded automatically using software capable of reading RSS or Atom feeds" (http://en.wikipedia.org/wiki/podcasting). Podcasting is just one strategy identified amongst a range of m-Learning strategies as identified by Stead (2005):

> SMS (text messaging) as a skills check, or for collecting feedback, Audio-based learning (iPod, MP3 players, podcasting), Java quizzes to download to colour screen phones, Focused learning modules on a PDA, Media collection using a camera phone, Online publishing or blogging using SMS, MMS (picture and audio messages), Cameras, email and the web (p.4).

In Wikipedia, M-Learning is defined as a different form eLearning, as it takes the learner away from a fixed point and "respects that a user would like to interact with educational resources whilst away from a normal place of learning-classroom or computer" (http://en.wikipedia.org/wiki/Mobile_learning).

The name *podcast* was coined in 2004 with the increased availability of portable audio and video players and particularly Apple's highly rated and best selling portable audio and video iPod. However, RSS has been available since 2001. It is considered a push technology in that a publish/subscribe model is promoted. Subscribers choose from feed channels, which means that files are automatically transferred from server to client.

Casting generally now encompasses a diverse set of terms and specific uses, such as autocasting, blogcasting, learncasting, MMS podcasting, mobilecast, narrowcast, peercasting, podstreaming, photofeed, soundseeing tour, vodcasting, voicecast, audio wikinews and phone casting. There is insufficient space here to describe all of these variations, but certainly, for the teacher using this form of mobile technology, they are each worth a good look. A cursory internet search readily supplies access to details. The speed at which these technologies have been taken up is a reminder that the digital native is certainly a defining phrase of our current generation. The Pew Internet and American Life Project (2005) states that approximately 6 million people (*n* = 22 million) who owned iPods or other MP3 players had downloaded podcasts in the USA.

In education settings podcasting has captured the imagination of possibilities. However, as Eash (2006) reminds us:

> the fact that the podcast is a new format isn't reason enough to use it in a school library. Instead, ask questions. Is it a portable audio format the best for this task? How does the podcast support my goals? How does podcast support student learning? (Eash, 2006, p.18)

Lee (2005) iterates that the novelty factor can influence teachers in how they use new technologies and it is necessary to think carefully about "whether or not this is actually going to result in meaningful learning" (p.19). He goes on to say that

> As learning and development professionals (we) need to make a conscious effort to evaluate both new as well as existing technologies and how we use them from a pedagogical point of view, taking into serious account both the cognitive as well as the affective and social factors that contribute to a successful learning experience (Lee, 2005, p.19).

This case attempts to understand fully how students use podcasts and whether how we as teachers have considered their use carefully.

Object of the research

The objective of the case presented here was to identify what experiences students had of using podcasts, whether using podcasts presented a significantly new learning opportunity, and whether podcasts impacted on study habits. The research presented here represents initial findings and is part of a larger study which includes qualitative data drawn from focus groups to explore more fully the uses and experiences of podcasts for enhancing learning outcomes. It is acknowledged by the researchers that this is a case in construction and as such unfinished. Staff perceptions of the value of podcasts remain to be incorporated; these can be drawn from the relative exam performance of the cohort involved in the use of the podcasts.

Methodology

This is a qualitative study that was designed to use a mixed-methods approach for collecting and analysing data. A case study strategy was chosen to frame students' experiences of the usefulness and impact on learning that podcasts had. As the case was undertaken by the authors to understand fully students' experiences within the Law School at the University of New England, it is what Stake (1994) also refers to as, an *intrinsic case study*. For the researchers it was important to know more about students' experiences and the effect of providing podcasts. A thorough literature review was conducted to inform the planning of the study and to assist in focusing the question. The topical question that emerged from this process was:

> Do students find podcasts useful in their learning experience?

During the first stage of the project a survey was developed to capture participants' experiences of using podcasts. The survey tool was only one method used to capture data for the case study and as such this study uses mixed methods in order to explore the phenomena fully. A survey was considered essential in order to be able to make comparisons systematically. The survey developed consisted of a broad range of questions based on a standard conceptual map. Participants answered questions that started quite generally and moved toward specific information relating to their knowledge, attitudes and behaviours in relation to the value of podcasts (Punch, 1998). These included questions about the participants, their uses of podcasts, characteristics and orientations of students in relation to podcasts, and the pedagogical place of podcasts as perceived by students' and their teachers. The questions were designed to be simple, specific and concrete.

Participants and context

The participants consist of 1244 tertiary law and business students during semester 1, 2006 who were studying in six law subjects. Law subjects were chosen due to the tradition of oral delivery being the primary teaching method. The participants represent the diversity expected within a blended mode delivery. For example, age, gender, ethnicity, international students, professionals, school leavers and mature age students. The University of New England delivers both on campus and by distance to students within the same cohort. Previously neither student cohorts had access to lectures via audio delivery, for their access anytime or from mobile or other technological devices. The School of Law at the University of New England decided to evaluate the blended approach for both internal and external students. While both cohorts have access to printed study guides and texts and uniformly designed WebCT sites, electronic reserve reading materials in pdf, it is intended to assess how students value the inclusion of podcasts of lectures. Internal students may also attend face-to-face lectures and seminars. External students may attend residential schools.

The case presented here is unique, as little research has been conducted into how podcasts are represented in learning, and while the case does not claim generalisability others may find it provides insights that ring true.

Methods

Data were collected using a survey tool and online focus groups. The decision to survey students was due to the large numbers of students and the need to collect background information to assist in understanding the phenomena fully. Online focus groups are a second stage and students have been asked to indicate their willingness to take part in these. Students have been sorted into random groups and are currently being conducted. Only the preliminary survey results of the survey are presented in this paper.

Data presented here were collected by an exploratory survey which consisted of 39 questions organized into i) demographic information, ii) podcast experience, iii) study habits, iv) UNE delivery method, v) conclusions. Data were collected from a sample from 1244 unique students enrolled in six Units (Table 1).

Table 1: Units involved in the survey

Unit	No of students enrolled†	Male	Female	No of respondents
LS 100 Introduction to Legal Systems and Methods	350	147	203	83
LS 151/251 Introduction to Business Law	148	68	80	42
LS 220 Constitutional Law	396	189	207	92
LS231 Law of Torts 1	288	122	166	75
LS281 Property Law 1	211	111	100	50
LS240 equity and Trusts	241	109	132	47
Total students	1634	746	888	389

Note. †Some students were enrolled on more than one course.

The sample was self-selected by those students who responded to notices placed on the unit WebCT sites. There were 565 unique males and 679 unique females in the population, a total of 1244. 389 students responded (a response rate of 31.27).

Data were analysed based on a range of question types. The questions required students to answer in some cases yes/no, or on a 5 point Likert scale and further by selecting specific statements. Ethical clearance was sought and approved.

Indicative results

In order to explore participants' experiences, students were asked questions under the following headings. There is insufficient space here to detail all of the results and the authors have drawn out some of the answers to provide indicative responses to the five categories.

Demographic information: Q 1–10

In answering these questions the participants detailed age, gender, EEO information, employment type, year of study, enrolment mode, number of units enrolled and in which Semester, type of modem and speed of connection and typical study habits.

The age demographics revealed the following pattern 18–24 (37.5%), 25–34 (33%), 35–44 (19.6%), 45–54 (8.4%), 55–64 (1.1%), and 65+ (4%). Females represented 63.2% and males 36.8% of the sample. External students represented 78.2% and internal students 22.1% of the sample. EEO demographics revealed .4% of Aboriginal or Torres Strait islander students, 9.1% of students whose first language was not English, and 2.5% of students with a disability. 48.8% of students were in full-time employment or volunteer. 78.2% of students were external. The distribution of enrolment was bimodal, 36.8% of students were enrolled in two units, 30.5% enrolled in four units in the semester examined. The majority of students were in the first (48.8%) or second year (24.6%) of their law or business course. The vast majority of students had broadband access: 56k (14.4%), 128K (17.5%), 512k (35.8%) and faster (18.6%). Typical study habits were split into three types: an hour or less several times a week for each unit enrolled (21.4%), a substantial session (2 hours or more) for each unit once a week (37.2%), and big bursts of activity every two weeks or so (27.7%).

Podcast experience: Q 11–20

In answering these questions the participants assessed their rate of knowledge of how to use podcasting, how many times they accessed podcasts, what they used to listen to the podcasts, overall value to studies, types of podcasts accessed, when they listened to podcasts, difficulties or issues in accessing podcasts and how they resolved such problems.

At the commencement of the semester podcasting knowledge consisted of no knowledge (46%), limited knowledge (22.8%), some knowledge (20.7%), considerable knowledge (8.1%), and expert user (2.5%). By the end of semester podcasting knowledge consisted of no knowledge (3.5%), limited knowledge (9.8%), some knowledge (31.2%), considerable knowledge (38.2%), and expert user (7.4%). There was a rapid uptake of podcasting with 84.6% of the sample accessing podcasts and thereby improving their knowledge of the technology. Students used their PC (72.3%), MP3 player or ipod (34%), and CD player (9.8%) to listen to the podcasts.

The value of the podcasts was evident in 67.7% rating them as excellent value, 14.4% rated as above average value. Podcasts were rated in order of participant's preference for internal lectures (75.8%), internal seminars (8.8%), and weekly summaries 2.8%.

In terms of importance students rated podcasts of lectures as very important (74%) or important (8.1%); podcasts of tutorials as very important (57.2%) or important (16.8%); podcasts addressing assessment preparation as very important (53.3%) or important (22.5%); and a quarterly podcast from the Head of School addressing activities in the school as very important (14%) or important (24.2%%) or neither unimportant or important (25.3%).

Podcasts were listened to on the way to and from work (20.7%), at work (13.7%) and at home (80%). Only 14% of students had difficulty in accessing or subscribing to podcasts. These problems were either ignored (4.6%) or resolved by the Internet (2.8%), friends (4.6%), university help desk (5.7%), or by the unit coordinator (1.8%).

Study habits: Q 21–29

In answering these questions the participants agreed or disagreed on a 5 point Likert scale on a variety of statements about their study habits, gave an indication of how much time they spent on various aspects of the course and provided extended comments about their study habits and how they were affected by podcasting.

In terms of the impact on the time they were spending studying primary material, 30.2 % of students agreed (22.5%) or strongly agreed (7.7%) they were spending more time on the study guide, 39.6% were ambivalent, 19.6% disagreed (11.9%) or strongly disagreed (7.7%). In relation to spending less time reading cases, 17.2 % of students agreed (14.4%) or strongly agreed (3.2%), 32.6% were ambivalent, 39.3% disagreed (21.4%) or strongly disagreed (17.9%). In terms of spending more time reading statutes 12.6 % of students agreed (9.8%) or strongly agreed (2.8%), 48.4% were ambivalent, 27.8% disagreed (20.4%) or strongly disagreed (7.4%). Finally in terms of spending more time reading articles and textbooks (34.1 %) of students agreed (23.9%) or strongly agreed (10.2%), 35.8% were ambivalent, 19.3% disagreed (14.4%) or strongly disagreed (4.9%). On balance, podcasting is reported with increased engagement with primary materials and study guides.

The vast majority of students considered that podcasting assisted their learning (17.9% agreed, 47.4% strongly agreed). Few students perceived podcasting as detrimental to their learning (2.8% agreed, 6% strongly agreed, 69.1% strongly disagreed, 5.3 disagreed). Students were specifically asked if podcasts of lectures were *not* useful to their studies – 79 % of students disagreed (9.5%) or strongly agreed (69.5%), 3.2% were ambivalent, 6.7% agreed (4.2%) or strongly disagreed (2.5%). It seems that the ability to replay podcast lectures was useful for their studies – 81.8 % of students agreed (1654%) or strongly agreed (65.3%), 3.5% were ambivalent, 3.5% disagreed (2.1%) or strongly disagreed (1.4%). Students agreed with the statement that the ability to pause a podcast, while checking other references, cases etc. – 81.8 % of students agreed (17.2%) or strongly agreed (64.6%), 3.9% were ambivalent, 2.5% disagreed (1.1%) or strongly disagreed (1.4%). Students tended to disagree with the expectation that podcasts would not have any impact on their final results for a subject – 70.4 % of students disagreed (27%) or strongly agreed (40.7%), 12.6% were ambivalent, 8.1% disagreed (5.6%) or strongly disagreed (2.5%).

One potential worry with podcasting is the time students devote to transcribing them. The jury is out on the costs and benefits associated with this approach. When asked whether they were spending time transcribing podcasts, 20. % of students agreed (12.3%) or strongly agreed (8.4%), 21.1% were ambivalent, 45.3% disagreed (13%) or strongly disagreed (32.3%).

In order to explore whether podcasting was associated with increased student interaction, students were asked whether they were spending time discussing podcasts with fellow students – 14 % of students agreed (10.5%) or strongly agreed (3.5%), 62.2% were ambivalent, 62.2% disagreed (30.9%) or strongly disagreed (30.9%). When asked if the availability of podcasts had decreased their participation on WebCT discussion forums, 9.9 % of students agreed (6%) or strongly agreed (3.9%), 15.8% were ambivalent, 62.1% disagreed (22.5%) or strongly disagreed (39.6%).

On one view the flexibility of podcasting can be perceived as beneficial to students who have to manage work, family and other competing time demands. When asked if podcasting gave more flexibility to manage competing claims upon their time, 65.3 % of students agreed (22.1%) or strongly agreed (43.2%), 15.4% were ambivalent, 6.7% disagreed (3.2%) or strongly disagreed (3.5%). One obvious connection with flexibility is the potential relationship with attrition. Students were asked whether the availability of podcasts had encouraged them to remain studying the unit – 63.2 % of students agreed (19.3%) or strongly agreed (43.9%), 15.4% were ambivalent, 9.5% disagreed (4.9%) or strongly disagreed (4.6%). These results have potentially significant implications for universities in dealing with student attrition.

UNE delivery method: Q 30–35

In answering these questions the participants provided evaluative information about how quickly they expected podcasts to be available and the quality of the podcast. Students expect podcasts to be delivered the same day (9.8%), the next day (26.6%) or the day after (24.6%). There is a clear expectation for swift delivery. While the majority of students rated the audio quality as good (47.7%) or excellent (11.9%), many students would accept longer download times for higher quality: download time x 1.5 times (35.8%), x 2 times (31.2%), x 3 times (7.7%), more than x 3 times (10.5%). Given the high percentage of swift broadband users the extra time involved many not be long in any event. Most students (78.9%) thought it advantageous to capture questions and comments from internal students. Most students (81.4%) thought they would benefit from being able to receive podcasts of internal tutorial discussions.

Conclusions: Q 36–39

In answering these questions the participants detailed in longer responses what they considered to be the main advantages and disadvantages of podcasting.

The main advantages of podcasts were expressed to be increased flexibility to manage competing claims on time, reduced attrition, examination preparation, and the ability to replay lectures, and pause lectures while checking associated reference material. Other advantages included providing a "clear overview" and contextualisation of topics, "convenience", "break from reading", "indication of lecturer emphasis", community building in the sense of involvement with the subject, "focus and motivation, a feeling of being part of the class", "provides external students with the same opportunities as internal students", ability to catch up if you miss an important lecture, "hearing additional examples/explanations given in lectures makes it much easier to understand than the 'dry' textbook", "They bring subjects alive, allow a lecturer to bring in their own experiences and personality to make subjects more memorable, and bring more humanity to what can be fairly dry material. It can be soul destroying, reading rule upon rule, with no navigator to draw it all together and make it real".

The main disadvantages of podcasting were expressed to be the perceived cost of implementation, lack of a visual link to overheads, PowerPoints or writing on the board, "not being able to ask questions", equity access issues, "difficulty of capturing peripheral sound", "delays in availability" and "download times", "additional time needed to listen to podcasts", reduction in internal lecture attendance, "lecturers don't necessarily think to repeat inaudible questions", and the perceived need to transcribe.

Conclusions

Beyond usual technologies such as computers, the Internet and email, our students have embraced mobile technologies with relish. Almost every student has a mobile device of some kind, whether a phone, PDA, a digital camera, or digital audio player. The explosion for example of Apple iPods over the past few years is just one example. Stead (2005), a leading researcher and practitioner at the forefront of the use and uses of m-technologies states that "the question is no longer whether m-learning works for hard-to-reach learners, but rather how best to fit it into your blend!" (p.1). He promotes

> taking the lead from the learner, and defines m-learning as making use of whichever devices and technologies surround our learners, in an attempt to empower and enrich their learning, wherever and whoever they are (Stead, 2005, p.3).

The lessons that he points out to would be incorporators of m-technologies are numerous; he suggests that they are best used as part of blend where they are combined with other approaches to learning such as ICT, classroom, and print materials, for example.

The School of Law at the University of New England has adopted this blended approach for both internal and external students. Both cohorts have access to printed study guides and texts, uniformly designed WebCT sites, electronic reserve reading materials in pdf, and podcasts of lectures. Internal students may attend face-to-face lectures and seminars. External students may attend residential schools.

This paper has provided an overview of the results gathered from a survey in an attempt to develop an *intrinsic case* to explore the question *Do students find podcasts useful in their learning experience?* While data gathered from focus groups is not presented here, the preliminary survey data thus far demonstrates some worthwhile information about students' experiences.

The participants are clearly in favour of podcasting. They identified the ability to time shift and have control over the replay of auditory course material as major advantages. Of the students who completed the survey, 20.7% confirmed our suspicions that podcasts were being transcribed. This is clearly a time consuming exercise compared with listening or note taking. An analysis of why this is the case, plus a cost benefit analysis of transcription has yet to be undertaken.

We were surprised that students (63.2%) placed such importance on podcasting as a support for studying subjects. This has important financial implications for universities struggling with student attrition. Anecdotally, unit coordinators of early core units suggest a 10% decline in attrition and a higher standard of answers in examinations, associated with the introduction of podcasting. This observation needs to be examined overtime and be considered with caution.

Unanswered questions that remain in our ongoing case study include the best method to support lecturers in preparing and delivering podcasts, including practical issues such as the speed of delivery, diction, the need to repeat student questions and comments. Administrative workflows need to be developed to streamline the recording process. Further questions also arise in relation to how students with a disability, in particular auditory deficits can benefit from podcasts.

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Describing a design pattern: Why is it not enough to identify patterns in educational design?

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In this paper we analyse the use of patterns across a number of fields including architecture, software development and educational technology design. Focusing on the reusability of a pattern outside its area of development, we have identified several issues related to the context and the value system of a pattern. The paper draws together lessons learned from different fields where patterns are already used and described. We conclude with a recommendation of pattern descriptors and guidelines which improve their applicability in varying value systems.

Keywords: design patterns, pattern format, design complexity, research and design values

Introduction

The term 'pattern' as used in this article was first defined by Alexander (1979) to mean a recurring problem-solution pair which can be observed under a variety of conditions. Alexandrian patterns in their most essential form consist of problem, solution and context descriptions; and this approach to patterns has been widely accepted by design sciences such as architecture, software development (Gamma, Helm, Johnson & Vlissides, 1995) and educational technology design (Derntl & Motschnig-Pitrik, 2005; Goodyear, 2005; Niegemann, Hessel & Domagk, 2004). Patterns, however, also have the potential to assist online educators in a broader sense during their daily activities – an important goal, because although online education design models are being created in increasing numbers, they are meeting with increasingly less acceptance from design practitioners (Conole, Dyke, Oliver & Seale, 2004). Niegemann et al. (2004), for example, suggest that design patterns have the potential to represent theory-informed design in a way that is closer to the everyday experience of designers and instructors looking for solutions to their specific problems, rather than purely as all-embracing, abstract models – which is how they are generally viewed at present.

Research objective

This paper seeks to analyse the way patterns are described and to show how such description affects their reusability in other, later designs. We argue that there is a need for greater transparency about what needs to be described (and why). We believe that pattern descriptions include a number of assumptions which, if not made explicit, limit their future dissemination, application and evaluation.

The paper begins with a brief discussion of pattern applications in architecture, software development and educational technology, including examples and domain-specific issues. To analyse the identified issues constructively, we next consider patterns as products of cultural as well as academic values; and provide examples of why it is important to differentiate these two types of values. We then discuss the process of applying patterns in a context-sensitive way and why patterns offer a potentially helpful approach to coping with design complexity. Finally, we match the issues identified against existing pattern descriptors and suggest a more comprehensive format for pattern description.

Pattern definitions and usage

In this section we review the current pattern-related discussions in the disciplines of architecture, software development and educational technology. Taking into account the fact that patterns have been discussed for more than 25 years in architecture and for over a decade in software development (Gamma, Helm, Johnson & Vlissides, 1995), however, we have had to limit this review to the works of a comparatively small number of authors – those who seem to encapsulate the views of pattern researchers within their field and who have been most frequently cited by later authors.

Architecture

Architectural patterns were first promoted by Alexander and colleagues in the late 1970s through their book '*A timeless way of building*' (Alexander, 1979):

> Every pattern we define must be formulated in the form of a rule which establishes a relationship between a context, a system of forces which arises in that context, and a configuration which allows those forces to resolve themselves in that context (Alexander, 1979, p.252).

In this definition, Alexander identifies the principal relationships of his pattern approach in terms of solution, problem and context.

Solution
A pattern describes a solution to an archetypal problem in a general way, but is not a recipe which can be applied without understanding the relationships described within the pattern itself; and between the pattern and its neighbouring patterns (Alexander, 1979, p.223). Patterns still need to be adapted to local conditions – they are a kind of modular knowledge which refers to other patterns at different levels of abstraction, best represented in terms of scalar relationships (Salingaros, 2000). Alexander takes an inductive approach to pattern mining: starting from observations and the idea of a good quality design, he abstracts the essential features of that design. These features will be the core elements of the suggested solution.

Problem
After identifying what captures the quality of a design (solution) in a particular situation, Alexander describes the problem in terms of forces dominating the scene (problem description). Forces are constraints on the quality of a pattern.

Context
Alexandrian patterns require contextual specifications for when the problem is most likely to be encountered and when the suggested solution is most likely to be successful.

Software development

Though the link between Alexandrian architecture and software engineering goes back as far as 1968 (Coplien & Devos, 2000), wide-spread adoption of design patterns only occurred when object oriented programming became the dominant approach (Gamma, Helm, Johnson & Vlissides, 1995).

Not all patterns, however, need to be object oriented. Coplien (1997), for example, takes a broader approach and notes that the definition of a pattern is (again in the Alexandrian tradition) the solution to a problem in a context, whatever that solution might be – reaching beyond classes, objects and methods:

> Software pattern practitioners have turned to patterns as reaction against this unsatisfying aspect [the formal and scientific grounding of software design with no reference to any value system] ... (Coplien, 2004, p.7).

Coplien's and Gamma et al.'s statements about patterns highlight some issues accompanying the usage of software design patterns: 'What counts as a pattern?' and 'What contributions to the design process can be expected from patterns?'

A much more open approach to the use of patterns is taken by Fowler (1997), who sees them as a way of formulating suggestions which may or may not be accepted by his clients. Regardless of whether a pattern is accepted or not, he emphasises, patterns are about clients getting to know their own systems. He argues that patterns have only a limited potential to be applied outside the context in which they were created and he delegates final decisions to the respective domain experts. Fowler also points out that the validity of a pattern depends on the use of a common framework, which defines the conditions under which it can be used in the future. If we take the reuse of software components as an example, such a framework could be a Visual Basic environment, or object oriented technology. As we show in the next section, Goodyear (2005) similarly argues for a pedagogic framework as strategic/ tactical guidance for applying patterns in e-learning.

Educational technology

One reason for introducing different pattern forms in educational technology design is to distinguish between the representational media used to implement them: *computer languages* (highly formalised representations, such as mark-up languages or programming languages), *meta-languages* (e.g. UML, E^2ML); and *natural language* descriptions (such as narratives or tables). This can be seen as an attempt to represent patterns in a human as well as a machine-readable format.

Computer languages
Efforts to create libraries of templates and learning resources link design patterns to the reuse of learning objects in different contexts, suggesting either a best practice *sequence* of learning objects, or a best practice *combination* of learning resources (Green, Jones, Pearson & Gkatzidou, 2006a). Adaptation to context is mainly seen as matching learning object meta-data with learner profiles (Green et al., 2006a). Though patterns can be transformed into physical representations, it is claimed that the use of highly automated patterns may: (a) impede adaptation, since this would imply additional encoding effort; (b) constrain the creativity of designer who generally prefers to take 'what's available' than 'what's most appropriate'; or (c) lead to a mismatch between the learning situation and pattern due to an overly general specification of pattern-related conditions and restrictions (Green, Jones, Pearson & Gkatzidou, 2006b; Heath, 2006). The last point, in particular, highlights the fundamental question of the degree to which a learning situation can be analysed algorithmically (Dreyfus, 1992).

Meta-languages
Motschnig-Pitrik & Derntl (2005) stress the importance of meta-languages such as UML to mediate between pedagogic design and software design. Care is needed, however, when using UML as the specification tool of choice because, although UML models reduce complexity by means of abstraction and modelling perspectives such as use case views, activity views or interaction views (Rumbaugh, Booch & Jacobson, 1999), parts of the semantic information included in the UML diagrams may remain hidden if the reader is not familiar with UML syntax. Modelling is a means to an end and there is a clear need to match pattern representations with their target audiences. UML was developed to support object-oriented software development (Rumbaugh, Booch & Jacobson, 1999) and the benefits of using UML to support design and diffusion of educational technology patterns outside IT-related education remain to be seen.

Natural language
Peter Goodyear (2005) identifies design patterns as new conceptual tools requiring a demand analysis. Demanded are "customizable, re-usable ideas ... there is no visible demand for complex methodologies …" (Goodyear, 2005, p.82). This approach is different from the two previous ones because Goodyear begins by sharing design ideas whose primary representation is textual. The benefit of a textual representation is that it is unlikely to impose itself on the designer, since alterations are made easily. Textual representations also have a wider potential audience, which at some stage may even include the learners themselves.

Cross domain issues and remedies

As the previous section has shown, the concept of design patterns has been embraced by designers from a number of different backgrounds. No matter whether patterns as a design construct were widely accepted and adopted by a research community as has been the case with software developers (Gamma, Helm, Johnson & Vlissides, 1995), or were viewed with less enthusiasm – as was the case with architects (Salingaros, 2000), issues relating to their application reappear in surprisingly similar forms across the various domains. Based on our review of pattern literature, we identified two sets of issues:

- the definition of patterns which usually originate in an environment with a homogeneous value system, including *institutional*, *pedagogic* and *methodological* values;
- the application of patterns in complex design environments; and
- the way patterns can adapt to emergent changes in context.

Institutional values: Identify cultural idiosyncrasies

The way patterns are understood and used has a significant impact on the way they are evaluated. Wottawa & Thierau (1998) point out that evaluations generally support decision-making processes by placing a value on alternatives. Commonly-held quality standards of the stake-holders involved therefore have a significant influence on the evaluation process.

Schein (1996) defines culture in institutions as a combination of visible norms, exposed values and deeply held assumptions. Applying Schein's concept of culture to patterns as design artefacts, two questions emerge: (a) do the inherent values of the patterns align with the users' culture(s)? and (b) what do we know about the users' culture(s) in the first place?

For example, Anderson, Plessis & Nickel (2001) describe a distance collaboration project by educators from a South African and a North American University: after the initial contact it was intended that a more in-depth discussion via asynchronous forum would take place. The authors reported, however, that this discussion process did not succeed because faculty members from the two universities valued online discussions very differently: while the North Americans saw online forums as a low-effort mode of communication, the South African institution – with little experience and an unreliable technical infrastructure – found it much more taxing.

Axiological assumptions: Make the pedagogic pattern value base explicit

Axiology is the theory of values (i.e. a group's moral, ethical and aesthetic assumptions) and determines what drives the design process (Banathy & Jenlink, 2003). Alexander was striving for universally valid patterns and Grabow (1983) supported Alexander's attempt to achieve a Copernican revolution in architecture. Though Alexander's assertion that a "purely intuitive approach to architectural design was no longer capable of adequately responding to the complexities of industrialization, urbanization and social change" (Grabow, 1983, p.6) may be viewed with sympathy, it is not clear that this issue can be resolved through the application of a single theory. Protzen (1978) points out that many statements in Alexander's pattern description are either inconsistent or of little empirical value for the formation of a coherent theoretical system; and then invokes the support of Feyerabend (1988), who criticises 'all-encompassing-theories' which, by excluding alternative views, close themselves to any criticism and run the risk of becoming ideologies.

In the case of educational technology patterns, values come into play when the instructional designer defines the more abstract conditions of the educational environment. Goodyear (2005) combines the more abstract elements of design into a pedagogical framework which represents the conditions and intentions for: the formulation of actual learning tasks; the definition of system features; and the organisation of group work. Though some patterns may be independent of any pedagogical background, others change their meaning if interpreted within a different educational paradigm (Marshall, 1996). A good example is assessment-related patterns, where the instructors' understanding of learning, valuable learning objectives and the learners' role directly influence their assessment pattern. Though all instructors may be using collaborative, problem-based learning, those working within a social constructivist value system will place greater emphasis on the student's own contribution to the learning process. By contrast, instructors using cognitive approaches will believe that the assessment focus should be on the level of acquired knowledge as the most reliable source of evidence for whether learning has taken place (Savin-Baden, 2004). An explicit description of the underlying pedagogic values of a pattern may also strengthen the position of an instructor who is asked to explain or justify a specific learning activity in combination with a given communication channel to get students fully engaged.

Research paradigms: Include data and methods applied

In the previous two sections, we have pointed out the potential which cultural, institutional and pedagogic values may have to prevent the success of a pattern – if not made explicit. The last set of homogeneous values critical to the definition of patterns is those inherent in the various research paradigms. Research paradigms are described by Habermas (1971) as 'Erkenntnisinteresse' (the quest for knowledge and cognition) and this is also true for the formulation of patterns. Before we can describe a pattern, we need to clarify its intention, to set the scene for its interpretation. A hypothetical pattern based on research results from computer mediated communication could follow one (or more) of the following three perspectives based on a positivist, interpretivist or critical research paradigm:

Positivist view
According to Popper (2002), scientific theories are about universal (time and location independent) statements which can be tested inter-subjectively: the higher the empirical content of the theory, the more precise that theory (Popper, 2002/1935, pp.4–22). Researching the use of communication technology from a positivist perspective would thus involve, in the most extreme form of this view: "quantifiable independent and dependent variables, and hypothesis testing, typically involving laboratory experiments and statistical inference" (Ngwenyama & Lee, 1997, p.149). A less extreme view of positivism would suggest an externally discoverable truth resulting from any research undertaken within the positivist tradition. The positivist perspective has a clear view of what is considered objective data.

Interpretivist view
Interpretivist studies take the approach that all truth is relative – interpretivist researchers do not believe that there is any externally discoverable, absolute truth. Interpretivists believe that the world is interpreted via the mind of the observer and that the language and symbols used by those describing what they perceive are an inherent part of that observed reality (Weber, 1922). Clearly, then, the concept of 'objective' data has little meaning for interpretivist researchers since they view all information as subjective.

Critical theory
Taking a Marxist perspective of research, critical theory opposes the definition of knowledge as 'knowledge of control' and argues for the inclusion of 'reflective knowledge' (Habermas, 1971, p.47), believing that while the former is crucial for technical processes, the latter dominates social processes. Critical theory requires researchers to question the social and historical conditions of what they observe and to uncover restrictions which may originate from accepting the status-quo (Orlikowski & Baroudi, 1991). Consequently, it is not sufficient to measure or explain circumstances – researchers must also 'emancipate' from them (Ngwenyama & Lee, 1997).

These three perspectives can perhaps best be compared by means of an example. A scripted collaboration pattern may have: a *positivist version*, focusing on the impact of what is technically possible to enhance collaboration; an *interpretivist version*, focusing on the group context to monitor and understand collaboration; or a *critical version*, focusing on changing the context – because a reward system which is geared towards measuring individual performance does not encourage collaboration in the first place.

The inclusion of this paradigmatic dimension has the advantage of clarifying why a pattern relies on certain data and how those data were obtained: and could greatly improve the credibility of educational technology design patterns.

Context: Provide positive and negative cases

Applying a design pattern to a real world problem means matching what is described as a workable solution to one's own specific problem. Since, in a socio-technical system such as an online learning environment, it is unlikely the same problem will occur in exactly the same context as that in which the pattern was developed, designers who would like to (re-)use patterns are confronted with implementation issues such as the contextual dependence of a pattern and the complexity characterising the design problem.

Context plays an important role in determining the adequacy of a pattern: architectural patterns, for example, are dependent on climatic conditions (Protzen, 1978) or institutional norms and rules (Bryant, 1994); and software patterns may depend on programming paradigms (Schmidt, 1995). So how do these differences in context affect the utility of a pattern? When should a pattern be discarded, or its contextual features changed? Context is also the issue which ensures the relationship of a pattern to an existing problem, e.g. how to ensure meaningful collaboration to a tested solution among all members of a group (Voigt & Swatman, 2006); or scripting a collaboration process so as to leave enough room for creativity and thus avoid scripted activities simply being ticked off and stripped of their educational purpose (Dillenbourg, 2002).

In deciding on the relevance of a particular context feature, not only should the optimal conditions for a pattern be stated, but also conditions under which the pattern has failed, or might fail. Consequently, to continue the example mentioned above, a script-using pattern might include information about when not to apply the pattern, e.g. when a learning community extends over different time zones, or uses highly heterogeneous technologies. Preserving critical cases which did not conclude as predicted are common practice in multiple case studies, where a theoretical framework is strengthened by theoretical replication (Yin, 2003, p.47). Similarly, a pattern may include critical circumstances under which the pattern failed, showing the need to either create the 'necessary' conditions, or to change the pattern itself.

Complexity: Provide concrete examples and abstract framework

The more contextual conditions and forces are contained in a pattern description, the more complex it becomes to apply the pattern to a concrete design problem. In this section we look at educational scenarios as complex systems and attempt to show how patterns provide a suitable approach for interacting with complex design problems. Emmeche (1997) differentiates between descriptive and ontological complexity: the former describes situations where various models and methods are needed to give a reasonably complete account of the phenomena under research; while the latter refers to situations in which, although there are discernable rules within the system, these are not predictable. Non-predictable, complex systems are typically characterised by 'emergences', i.e. not all higher level phenomena can be deduced from lower level phenomena, thus creating new patterns in a system's behaviour (Goldstein, 2004).

Ontological or emergent complexity poses a problem for the prescriptive power of design patterns. Though they capture 'proven' design knowledge, new designs need to be monitored so that the researcher may become aware of emergent, unforeseen side effects. Emergent complexity may be dealt with by giving extensive examples which illustrate differing instantiations of a pattern. Concrete examples support the understanding of patterns as partial views of complex situations which adopt different perspectives. Examples have the benefit of linking together otherwise disjoint, abstract components of formal descriptor categories in a narrative way.

To obtain the full benefit from these narratives, designers need to enter into a hermeneutic dialogue with a pattern and its examples. A fundamental principle of hermeneutics as represented by Gadamer (1994) is the '*hermeneutic circle*' of interpretation: "we must understand the whole in terms of the detail and the detail in terms of the whole" (p.291). Applying this approach to the interpretation of patterns: 'we understand the pattern through examples and the example through the pattern'. A major benefit of design patterns is that they allow for the *reconstruction* of complexity and context by the designer due to the mix of abstract models, real examples; and hermeneutic dialogue.

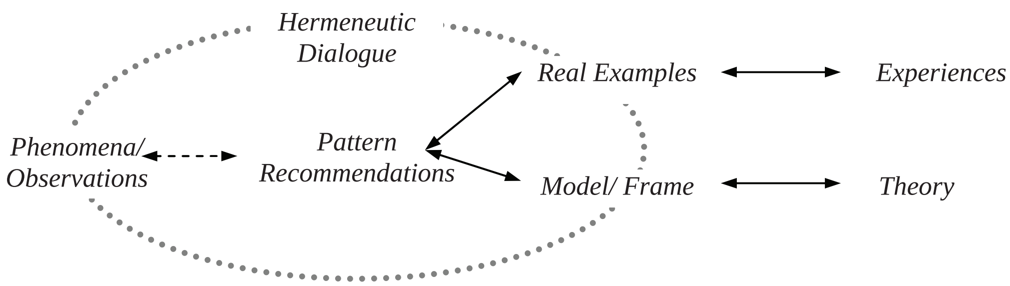

Figure 1: Pluralistic pattern interpretations

The dashed line in Figure 1 indicates the incomplete relationship between the enactment of a design situation and the predictions of a pattern – 'incomplete' because of complexity and contextual issues as discussed in the two previous sections. By claiming less generalisability and providing more contextual information, patterns actually enable designers to make some design decisions on their own. A pattern's value does not lie in its suggestions alone, but also in its support of a hermeneutic dialogue and the designer's learning to use the pattern in a context-sensitive way.

Suggested pattern descriptors

In previous sections we identified a need to understand, refine and possibly adapt a pattern when applied in a different context. In order to provide the user of a pattern with the necessary means to do so, we have expanded the traditional triplet of *context*, *problem* and *solution* with a fourth category *evaluation*. We are aware that this represents a change in the use of the pattern format which so far has been understood to capture 'approved' knowledge. However, since the dissemination of patterns in areas others than software development has proven to be problematic; we argue, that users need the means to evaluate the performance of a pattern by themselves. Table 1 is a synthesis of the various pattern description formats used in architecture, software development and educational technology design; and provides a useful tool for would-be re-users of patterns – as well as developers of new patterns in these areas.

Table 1: Pattern descriptors

Category/ descriptor	#	Explanatory question
Context		
Problem context	1	Under which circumstances the problem is likely to occur?
Pattern conditions	2	Under what conditions the suggested solution should or should not be applied?
Educational paradigm	3	What is the epistemological frame of reference to formulate a Pattern?
Domain specifics	4	What contextual characteristics need to be preserved (usually the invariables)?
Composite patterns	5	How does the pattern complete a larger pattern?
Networked patterns	6	Any other patterns making use of or being used by the pattern.
Similar patterns	7	Which patterns are closely related and how are they different?
Problem		
General description	8	What describes the problem?
Conflicting forces	9	Which are the forces in conflict?
Problem example	10	What are examples of poor design?
Problem scope	11	At what scale does the conflict occur?
Deepness	12	How deep does the conflict reach?
Substance	13	What are the structures and activities involved (physical environment, activities)?
Solution		
Name / Title	14	What summarizes the solution?
General description	15	What describes the solution?
Introduction	16	What is the pattern's intent?
Aliases	17	What are other well-known names for the pattern?
Principle	18	What general principles give base to the solution?
Pattern visualization	19	What displays the pattern best?
Structural Changes	20	What characterizes the physical / structural environment?
Activity Changes	21	What events / activities need to be sustained?
Participants	22	What are participating elements and what are their responsibilities?
Participants Interactions	23	How do the participating elements collaborate to carry out their responsibilities?
Interaction Diagram	24	How can the relationships within the pattern be visualized?
Consequences	25	What are the effects and side-effects of the pattern?
Pattern Flexibility	26	Which aspects of the solution can be varied independently?
Prototype Information	27	How would a concrete implementation look like?
Known use	28	Where has the pattern already been implemented?
Evaluation		
Evaluative Data	29	What is the empirical background of the pattern?
Evaluative Context	30	What methodology guides the evaluation of a pattern?
Evaluation Method	31	What data gathering methods were used?
Stability	32	Is the pattern stable and self-sustaining? (e.g. Alexander's 'Living patterns')
Coherence	33	Does the pattern integrate with other patterns?
Status	34	How well is the pattern established?
References	35	Where can further explanations be found? (based on in-text citations description)

Table 2 provides a further additional tool, by providing an overview of how the pattern descriptors in Table 1 address the various issues described in this paper. By mapping specific descriptors to specific issues, Table 2 is intended for use as a guideline during the pattern description process.

Table 2: Design issues and pattern descriptors

Issue	Descriptors (#)
Cultural values	Including specific domain characteristics (# 4) helps to understand the invariable part of the context which, if variable in the user environment, may lead to the development of a different pattern.
Design values	Design values are included in the contextual description of a pattern. ‘Paradigmatic conditions’ (# 3) refer to the pattern author’s assumption about learning and what is taken as a benchmark to determine design quality. As for the later descriptors #32 to #34 describe general pattern quality characteristics. They indicate the desired evaluation outcome dimensions (coherence, stability and status of patterns) which need to be addressed in addition to the evaluation of pattern-specific outcomes.
Research values	Descriptors #29 to #31 represent the ‘how’ of the evaluation or, as outlined in the previous discussion, the ‘data and method’ perspective on patterns.
Context	Pattern conditions (# 2) describe context as a prohibitive as well as an enabling factor, thereby increasing the transfer of negative and positive design expertise captured in a pattern.
Complexity	Grand theories reduce the complexity of the actual design conditions by imposing a reductionist model of the situation. Whereas a theory uses universal concepts, a pattern reduces complexity by referring to repeating design problems under similar conditions. Though patterns are less generalisable, their format has the potential to better adapt to the complex variety of design situations.
Emergent Complexity	Abstract principles (# 18) and concrete examples (# 27& #28) support the designer in learning and understanding a pattern’s meaning. The responsibility for deciding whether a new design condition makes it necessary to alter or discard the pattern is left to the designer. Both, abstract and concrete pattern presentations can provoke a hermeneutic dialogue between the pattern text and the designer. A pattern which provides more examples is likely to allow for more learning if each example represents a slightly different implementation of a general principle. The degree to which a principle is malleable is captured by descriptor #26.
Descriptive Complexity	Patterns combine different modes to present design experiences. This may range from a metaphorical picture (# 20), via textual descriptions of pattern components (#20, #21) to a process diagram (#24). Again, representational gaps due to the increasing complexity of a pattern need to be filled by the reader of the pattern. Such a gap may lead to a new pattern which eventually feeds into the larger pattern (#5) or may be filled with an additional example (#28).

In the 15 pattern related projects we analysed for this paper, we found no other authors who had developed as many descriptors as we have suggested here (Gamma et al., 1995) developed the most detailed pattern format, using 16 descriptors). We are aware that, in suggesting 35 descriptors, we have increased the effort of describing a pattern considerably – but we believe that the lack of effective pattern dissemination to date justifies our approach. Clearly, however, only further studies of the pattern dissemination process by a number of users will show if this additional effort will translate into the wider adoption of educational technology patterns which we anticipate.

Conclusion

Educational designers are faced with the problem of constantly reinventing concepts which may well have already been developed by others. The complexity of course design and the contextual importance of both the educational environment itself and the theoretical paradigms within which educators work makes the reuse of other developers' solutions problematic. One potential solution to this problem is the use of patterns, which provide a guideline and the ability to build on earlier work, without tying the educational designer too tightly into the details of his/her predecessor's activities or theoretical viewpoint. In this paper, we have endeavoured to show that it is the ways in which patterns are described which can have the greatest influence on the later reuse of those patterns. In particular, we have focused on the issues of context and of value systems – building on literature in this area and highlighting the cross-domain issues which both complicate the development and use of patterns in educational design, as well as enhancing the potential flexibility of patterns within this context.

The paper not only investigates the theoretical contribution which earlier researchers into patterns have made to this discussion, but also provides a detailed guide to suggested pattern descriptors – contained within two Tables, for ease of reference and use. We hope that this paper will also serve to draw together some of the many separate threads of research in this field, linking the description of patterns across architecture, software development and educational design.

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Thoughts on blogging as an ethnographic tool

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The personal development that takes place within the institutional framework of the PhD has in the last decade attracted the attention of researchers and bureaucrats in Australia. The institutional framework that supports the degree, the experiences of individual students at set points in their process, the experiences of supervisors and the development of pedagogies of research have all been subject to investigation. However, the development of web logging software (blogging) has now made it possible to undertake a longitudinal study of a group of candidates. My project aims to create a community of PhD candidates who are prepared to both maintain weblogs (blogs) themselves and to read and comment on the blogs maintained by the other members of the group. Through these blogs I hope to 'open a window' onto an experience that has been characterised as mysterious and even inherently distressing. Issues have been raised concerning both studies and education conducted in online mediums: whether the internet is a culture or a cultural artefact, how it is understood and viewed by its users, and whether the degree of performativity inherent in self-presentation on the internet might be fatal to authenticity. These discussions are pivotal to the development of my PhD.

Keywords: online ethnography, doctoral process, blogs as research tools, research pedagogy

Introduction

The journey of development that researchers and scholars take within the institutional framework of the degree of Doctor of Philosophy has in the last ten years attracted the attention of both academic researchers and bureaucrats in Australia. Some researchers (Neumann, 2003; McWilliam, 2002) have been concerned with the institutional framework that supports the degree, Others (Pearson & Brew, 2002) have researched the way that supervisors approach their task and made recommendations about the training that might be appropriate for this role. Still others (Lee & Green, 1998; Lee & Williams, 1999; Lee, 1999; Johnson, Lee & Green, 2000; Macauley, 2001; Vilkinas, 2005; Boud & Lee, 2005) have been more interested in what the experience of individual students reveals about both supervision pedagogy and the dominant discourses within academia concerning this highest rank of examinable degrees.

No study has thus far followed and tracked a group of candidates through their degrees, perhaps because until now there has not been an easy way for a group of candidates to interact and share their experiences as they happen. The development of software that supports the real-time online recording of events as they happen, a process called web logging (colloquially known as blogging), has now made a longitudinal study of this kind possible. My PhD project is to examine the process of development of a small group of PhD candidates over a period of at least one year by providing each of them with a blog and asking them to keep it updated at least semi-regularly and also to read and comment on the blogs of others in the project. In this paper I want to look at some of the issues of doing research online (methodology), what blogs are and why I am using them for this study (method) and briefly at some of the theories about how people learn online, and then discuss how both these theories and the results of my study might contribute to the development of one pedagogy of research skills.

Methodology

Debates concerning the purpose of ethnographic writing are ongoing, and are difficult to disentangle from the debates concerning both reflexivity and the political implications of writing ethnographies. If an ethnography is the story of a people, bounded by time and place, and ethnographers immerse themselves in the lives of communities they study to somehow 'know' them, how much does the Ethnographer's Tale become an element of the ethnography? And how much can or should a community be changed by the experience of being the subject of an ethnography? Then there is the vexed question of how the ethnographer can ethically re-present her subjects. These issues have been the subject of much of my thinking in the year since I enrolled in a PhD, with the purpose of creating a community of PhD candidates in order to get some insight on the process of becoming a scholar, the making of a doctor.

A two-part special issue of the Journal of Contemporary Ethnography (1999), with the general title *Reflections at the Millennium's Turn,* surveys current thinking about ethnography and its future. Denzin's essay 'Interpretive ethnography for the next century' makes a heartfelt plea for ethnography to become more political:

> This is a return to narrative as a political act, a minimal ethnography with political teeth. It asks how power is exercised in concrete human relationships. It understands that power means empowerment, the give and take of scarce material resources. It seeks performance texts that tell stories about how humans experience moral community. (Denzin, 1999, p.510)

The issue of how 'power is exercised in concrete human relationships' between supervisors and candidates in the academy, which prides itself on being a 'moral community', has been discussed and dissected by Lee and Williams (1999) and Johnson, Lee and Green (2000). Their insights into the lenses with which PhD development has been viewed in the academy have been fruitful in the development of my thinking about what a PhD is, should be, could be and might be.

Doing ethnography online

Ethnographers have traditionally gone somewhere to study a community; online ethnography is done "on the seat of the pants" (Hine, 2000; Markham, 1998). It's the ethnography you can do without leaving your desk. Ethnographers traditionally 'immerse themselves in the life of a community' – does reading email in a closed group or participating in a chatroom provide material for an ethnography? Further, what does 'life of a community' mean in this context – as Rutter and Smith (2005) write at the completion of their ethnography conducted in a newsgroup, "What does withdrawal amount to when you have never really been fully 'there'?" (p. 88). Finally, when members of a community live most of their lives outside the context that forms the basis of a study (although not outside its influence, a point which will be discussed below), the 'immersion in the life of a community' that ethnographers aim for raises issues about the meaning of time in an online ethnography. Hine (2000) talks about "temporal dislocation" (p.65) to describe the feeling of moving 'in' and 'out' of online communities, which may move on where you're not there, but will also leave a permanent record of all changes. In my project, not only am I (as the ethnographer) a visitor to this community – the community that I have created – but even the subjects only visit this community intermittently. Yet in a sense we are 'there' all the time, while the study progresses: our words are there and can be responded to even when we are not.

The question of the distinction between 'real life' and the discussions that take place in 'virtual life', and which informs what when, is also ongoing. However, following Baym's seminal study of online discussion groups (1995) it is usually considered that "online groups are … woven into the fabric of offline life rather than set in opposition to it" (quoted in Hine, 2000, p. 144). In my project, as in Hine's ethnographic study of websites that grew up around the 1997 arrest in New York State for murder and subsequent trial, conviction and deportation of the young British nanny Louise Woodward, offline experiences will actually create the fabric of the online. Additionally, online discussions may in turn influence the offline, which may then create more material for the online community, and so on….

Hine (2000) begins her book with a long discussion about the nature of ethnography as it is conducted in cyberspace, starting with the question of whether the internet is a cultural artefact or constitutes a culture in itself. How this question is answered by a researcher will determine both how a study is conducted and how its results are contextualised. How it is understood by ethnographic subjects will determine how they respond to an ethnographer.

Her answer, in short, is that it is both. Being both created by and used by humans as a tool, it is a cultural artefact. Joinson (2003) uses Vygotsky's (1978) word 'mediation' (explaining how tools allow for the extension of human capabilities), in his discussion of how word processing has affected the way we think about writing and editing. The online environment, similarly, has affected the way we think about written communication. Until now, all internet communication has been written; now images repositories such as flickr, video repositories such as U-tube, and VOIP (voice over internet – effectively free phone calls using internet connections instead of mobile or landline networks) are helping to create what is becoming known as the Web2 environment – an environment that users create for themselves rather than being passive consumers. The word 'produsers' has been coined to describe this phenomenon, and it remains to be seen how these will affect the way we view communication in the future.

I would suggest that in the six years since Hine published *Virtual Ethnographies*, the internet has become a kind of super-artefact: the meanings that its users attach to it have been shown to be out of the control of its inventors, of the individuals who continue to develop and maintain it, and of governments and institutions of any kind. Microsoft attempted to control its use with its Internet Explorer and Outlook programs, but was not entirely successful; open source software is rapidly taking their place, at least among savvy users and outside the corporate world. The Chinese government is (also unsuccessfully, for the most part) attempting to control its citizens' use of it at the present time.

As a culture, the internet is as diverse as the cultures that make up any nation. But even this statement is, in a sense, meaningless. Hine (2000) considers herself to be "a culturally competent web surfer" (p.142). But she also points out that her claim is without evidential foundation – who could measure such a thing? There are whole continents of cyberspace that I have never visited and have only the vaguest idea about. They could turn out to be reflections of what I already know, or they may be entirely different – I have no idea. Yet I would consider myself to be an advanced web surfer – I know how to navigate it and read it, to have a gut feeling for the reality it is presenting me; I use it in very sophisticated ways.

Incidentally, I think that it is interesting that we use such geographical terms – place, space, continent, navigate to describe our adventures in cyberspace. Cyberspace is a medium – a word that immediately conjures up thoughts of unreality, of 'in-betweeness' between the real and the unreal, the corporeal and the spiritual. Also, quoting the old joke, is it a 'medium' because, like television, it's neither rare nor well-done? But it is also a real place where real things happen. There have even been attempts to map cyberspace: www.cybergeography.org gives a history and describes current theories of 'mapping' in cyberspace. However, I would suggest that change on the Internet is so ubiquitous that it's impossible to map it in any useful way, at least using maps that are modelled on real-world maps. The territory you have come to know and understand today may have changed its significance entirely – if it still exists – in six month's time. In the blogging community I am creating, the blogs will change and morph throughout the period of the study.

Cyberspace has boundaries, but they are of a negative space – we are not 'there' when we are away from our computers – although of course that statement is also becoming outdated as mobile technologies give us the opportunity of being connected 24/7. It has laws, but they are contested and variable from one 'region' to another: in some places it is fine to be aggressive and to 'flame' other 'residents'; in others this is a reason to be banned from interaction. Although it is often held that it is not good behaviour to repeat what is written in cyberspace in another forum, whole areas are dedicated to mocking the communications of others. The landscape is mysterious and unknown – markers change from day to day and the outcome of repeated actions may be variable. It often feels shifting, unsafe and uncertain. Rutter and Smith (2005) liken their involvement in a newsgroup to a telephone call: "… the place inhabited by the … newsgroup is defined only by acts of interaction and communication" (p. 85).

So what landmarks do we use when we are moving around cyberspace? Hine (2000) suggests that the spatiality of the web is related to the territory of different websites (or blogs). You recognise them as soon as they open – you know 'where you are'. When the Sydney Morning Herald redesigned its web page this year I was quite lost for several days, looking for my favourite links in the wrong places! And Hine also points out that we make meaning in cyberspace from the connections between sites as much as from the sites themselves – in my study the connections that the participants make between their blogs (i.e. between their reported experiences) in their comments will create the data for my thesis as much as the blogs themselves.

Ethnographers need bounded sites for their study; they define a bounded culture as their subject. I am creating a bounded site – the blogs won't be visible to the trawling bots of a search engine, although people can give others the address of their own blog if they want to. And the study takes place within the bounded culture of Sydney University, which occupies a physical place on earth. However, unlike an ethnography conducted in a bounded geographical area, the participants will bring many different cultures to this 'place' that I am creating the shell for, and that they will furnish and decorate: their cultural backgrounds, their disciplinary culture, their lives – as graduate students and whatever else. And of course we will all create a new culture, one of PhD bloggers that will be unique to our site. The spatiality issues in this study, the spatial divides and dimensions of the blogging community, will be provided by the disciplines, epistemologies and methodologies of the participants, not by their physical placement in the geographical sense (Becher & Trowler, 2001).

This study seems to be unique in its longitudinal nature and the level of immersion – other published studies of the PhD process have taken slices at progress points and conducted interviews, although Vilkinas (2005) asked candidates and recent graduates to each write a piece reflecting on their process. My idea of taking a group of candidates, keeping them in touch with each other for an extended period of time – maybe up to two years – and keeping a record of their interactions, will produce a lot of data, and should reveal something of what the PhD process means for the participants. One of the key pillars of the study is that it will depend on asynchronous communication.

There is a long history to the idea that asynchronous written communication can build relationships (e.g. war brides, pen pals). Salmon (1999; 2002) (among many others) has discussed how asynchronicity can lead to deeper and more reflective discussion in an online community – it will be interesting to see if this is borne out in my study, because my initial research question is “To what extent can PhD candidates be sustained in their development as researchers through the use of blogging?”.

Questions of time in cyberspace, as we have seen, are closely linked to issues of presence and absence, which lead in turn to questions about embodiment and performativity. The absence of embodied presence in online communication foregrounds the performativity of the experience. As Markham explains

> To be present in cyberspace is to learn how to be embodied there. To be embodied there is to participate. To participate is to know enough about the rules for interaction and movement so that movement and interaction with and within this space is possible. Although this may not be so different than what we experience whenever we enter any strange context, it seems very blatant in cyberspace, perhaps because this process cannot be ignored, and because movement and interaction create embodied presence, not simply accompany it. (Markham, 1998, p. 24)

I have often been asked whether it will be a problem for my study that I can’t see my participants – that they may be lying or may not even be who they say they are. I find this an interesting question, as it reveals a belief that participants in face-to-face interviews would never lie, or that the researcher would be able to discern if they did. As many famous historical examples have demonstrated, participants in ethnographies have been lying to ethnographers since ethnographies began. As my study is of long duration it would require a considerable effort to construct and maintain a false identity within it. Hine, anticipating such criticisms of her defence for doing ethnography online, finishes her study with this explanation:

> I set out, not to investigate who people really were, but to interact with the features of their identities with which I came into contact. Identities [in this study] have been treated as situated performances, and as resources for the undermining of accounts.
> (Hine, 2000, p. 144)

Similarly, in my study I am not setting out to create an ‘authentic account’ of what a PhD is and how it is done; I am attempting to 'interact with the features of their identities' that participants choose to share.

Method

What is a blog and why is it a suitable tool for a study of the PhD process? A blog is most quickly described as an online diary. It is a special kind of webpage that has inbuilt features that enable the user to easily update it regularly. It has also has the capacity to store and display files, links and photographs, both in the text of the entries themselves and in sidebar areas. Importantly, blogs come with the built-in facility for readers to make comments on what they have read.

Blogs have been described by Williams and Jacobs (2004) as having 'the capacity to engage people in collaborative activity, knowledge sharing, reflection and debate, where complex and expensive technology has failed' (p.232). A blog is not only a space to write, but also a place to store and display pictures and graphics and make lists of links to useful references, to your work in progress, and to work completed. A blog is thus more like a cyber-desk than just a place to make and store notes, and a blog's ability to be shared adds the dimension of an ongoing conversation – the cyberdesk has a place for passers-by to add their comments to what they read, and in this study it is intended that the blogs of group members will be open to each other for comments, and that the blogs will be the tool for community building within the group. Although academic thinking about the uses of blogs in higher education is in its infancy, these uses are also continually being charted, discussed, predicted, reported and glossed in detail on blogs such as Weblogs in Higher Education. A very short list of education blogs (commonly called edublogs) is appended to the reference list. This tendency of blogs to comment on and aggregate the contents of other blogs is often referred to as 'the blogosphere'. As a 'region' of the internet (Hine, 2000) blogs are both a culture of their own and a cultural artefact. In this study they are the tool for gathering data, but they will also create a culture for the period of time that they exist.

I had originally thought of using an email list to conduct my study. However, websites, having the ability to be personalised with colour, text styles, pictures and layout, express personality more broadly than plain text. As Forte says, "Websites do not just tell stories; they contain stories within them about themselves." Both Forte (2005) and Hine (2000) believe that websites are given meaning by the links between them – by the communities that grow around, among and between them. With the addition of pictures, embedded links and the ability to leave comments, frequently updated weblogs give their owners the power to make strong statements about themselves, their feelings, beliefs and values. The availability of cheap and even free blogging software in the last five years has made it easy for even a novice to create and maintain a blog. Bloggers generally feel a sense of ownership in their blogs, and I hope that my participants will enact their own personal performances within the space I provide.

In addition, blogging seems particularly appropriate for my study because

- it is always everywhere available – this is literally true with the introduction of moblogging – the facility to post both text and pictures to a blog from a mobile phone
- PhD candidates are already familiar with the internet as a source of information, communication, and perhaps also support and organization
- participants retain control of their blog – it doesn't disappear at the end of a 60 minute interview
- it emphasises the idea of PhD as process rather than project.

The non-educational social nature of blogging has been explored by Nardi, Schiano and Gumbrecht (2004) who claim that "blogs create the audience, but the audience also creates the blog". Their study of 23 social blogs maintained by university students, graduates and graduate students also found that the social dimension of blogging made blogs much more than online diaries; they classified the motivations that bloggers had to continue their blogging activities as to (p. 4):

- update others on activities and whereabouts
- express opinions to influence others
- seek others' opinions and feedback
- "think by writing"
- release emotional tension

With the possible exception of the first item in this list, which is the most transparent motivation for anyone to keep a blog, each of these objectives will provide a dimension in this study on the socialization of PhD candidates into academic argumentation and research culture. The last two are particularly interesting in the terms of writing about both the place of writing in the creation of 'the doctor' (Lee, 1998) and the 'distress' inherent in the PhD process in Australia (Lee, 1999).

Postgraduate pedagogies/online pedagogies

Johnson et al. (2000) explore the development of the ‘autonomous researcher’ in the terms of the traditional model of PhD pedagogy, which Leder (1995) refers to as having an ‘apprentice-like’ quality. Its fundamental aim was to teach candidates independence, using techniques that mostly amounted to varying degrees of abandonment. However, some supervisors who have challenged these practices and attempted to undertake a pastoral supervisory role report being overwhelmed by the needs of their students. Johnson et al. suggest that autonomy may need to be *developed* in candidates, rather than *revealed*, and point out that “new modes of knowledge production”(p143) and the current trend toward more collaborative production of knowledge within universities will require that researchers have more skills in collaboration, supported as they are, increasingly, by joint process. More recently Boud and Lee (2005) suggest that

> a more appropriate pedagogic discourse should draw on the familiar notion of ‘peer’ from the world of research. It argues that peer learning, appropriately theorized and situated within a notion of communities of research practice, might be a productive frame through which to view research education. (Boud & Lee, 2005, p. 501)

This proposed more constructivist approach to postgraduate pedagogy has echoes in the theories of how people learn online. Most successful online learning is associated with constructivist pedagogies (Maor, 2003). The well-known and often-repeated advice to teachers going online that they will have to move from their position as the ‘sage on the stage’ to the ‘guide on the side’ implies the pedagogical position that students learning online are constructing their own knowledge from the available information, rather than accepting their knowledge whole from ‘the master’.

The development of blogs and wikis (online tools for collaborative authorship) as educational tools has the potential to reduce the role of the ‘guide on the side’ even further – perhaps online teachers, like the absent supervisors reported in so many studies of doctoral candidate development, are now becoming ‘the ghost with no post’. While those words are mine, the fear that teachers will largely disappear from education is often related to the development of educational technology without an attendant pedagogical framework (e.g., Taylor, 1995). Students working online can be left to share, discuss, problem-solve, and develop their own knowledge from sources of information that are now vast – indeed, as has already been discussed, the resources presented by the internet seem almost limitless. They must learn to judge the validity of what they find for themselves, and to develop the skills necessary to defend their positions within and through a group of people whom they may never see face-to-face. The (often misunderstood) role of ‘guide on the side’ is crucial to the success of this kind of educational setting (Salmon 1999; 2002).

Economic pressure rather than pedagogical preference is often the driver for institutional movement toward online teaching. It is also economic pressure that has raised the interest of both bureaucrats and academics in postgraduate pedagogy: pressure to lift completion rates has conflicted with increased time pressure on academics and an expressed wish by some academics for a ‘softer’, more supportive model for PhD supervision (Johnson et al, 2000).

Figure 1 uses a composite theory of online pedagogy to show how blogging might support the development of candidates. As online tasks move from academic engagement in reading material that has been placed online, through the social engagement of chat rooms and the more thoughtful and reflective work that results from reading and contributing to asynchronous discussion, participants move toward involving their emotions in the learning experience (Salmon, 1999). It is this involvement of the emotional dimension that has been identified by Lee and Green (1998), by Johnson et al. (2000) and by Boud and Lee (2005) as the most under-theorised part of PhD pedagogy. The use of blogging over time in this study will provide an online environment that will enable trust to build in the community, so that participants might establish emotional connections and relate in new and unpredictable ways.

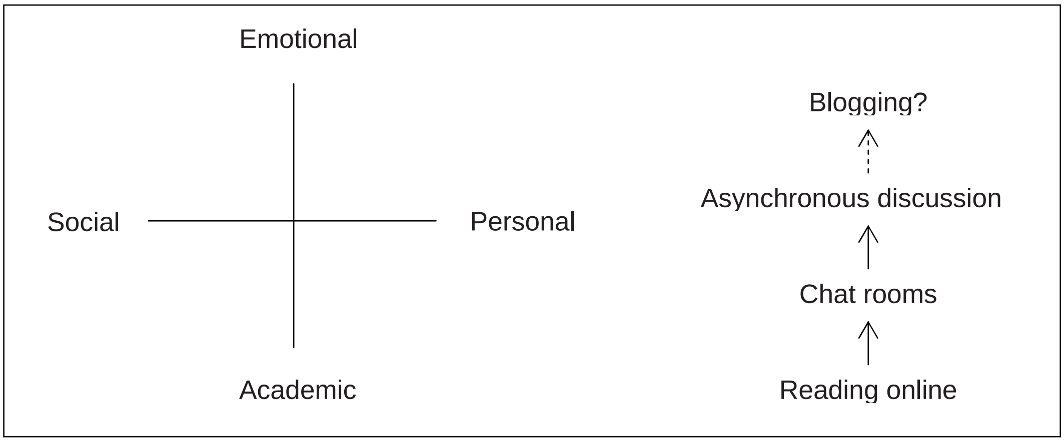

Figure 1: The pedagogy of cyber learning

A community of blogging PhD candidates has the capacity to bring together people who are learning how to become – how to negotiate for themselves – the building of the identity of 'doctor', both against and within disciplinary cultures and institutional strictures that can be traced back to the ideas of Voltaire and Rousseau (Johnson et al., 2000). Supervisors, of course, are themselves the product of this process and have been profoundly influenced by their own process of self-creation in their doctoral role (Pearson & Brew, 2002). This study will contribute to the complex question of how pedagogy can be understood within the supervisor/candidate relationship as discussed by Lee and Green (1998), and, most importantly, will be understood and enacted in the university of the future. At the heart of these issues lie the questions posed at the end of their article:

> How is pedagogy to be best understood, in all its complexity and necessity, within the symbolic-disciplinary economy of the Academy? What stories (and counter-stories) need to be told? What spaces are there for different practices and voices in post-graduate contexts, including research in and for postgraduate studies and pedagogy? What new imaginings are necessary for teaching and research in and for the emerging postmodern university?
> (Johnson, Lee, & Green, 2000, p. 44)

Despite the differences in epistemologies that have often been categorised across disciplines (e.g., Becher and Trowler, 2001), the blogging by individuals of the common ground of their struggle (which may, in any discipline, involve 'distress', according to Lee and Williams, 1999) has the potential to create shared narratives of development.

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Educational weblogs

- Weblogs in Higher Education
  http://www.mchron.net/site/edublog.php
- Educational Weblogs
  http://educational.blogs.com/
- Seblogging (Sebastian Fiedler)
  http://seblogging.cognitivearchitects.com/
- Stephen’s Web (Stephen Downes)
  http://www.downes.ca/
- Incorporated Subversion (James Farmer)
  http://incsub.org/blog
- elearnspace (Gerry Seimens)
  http://www.elearnspace.org/blog

Bionotes

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Use of visualisation software to support understanding of chemical equilibrium: The importance of appropriate teaching strategies

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This paper describes the results of a study in which a group of science pre-service teachers used computer-based visualisation software resources to develop teaching strategies and lessons that would support the development of students' conceptual understanding of chemical equilibrium. They used SMV: CHEM, VisChem and chemistry software packaged with textbooks. The goal was to assist science/chemistry teachers to design lessons that would overcome known difficulties in developing students' understanding. Four teaching strategies of one teaching team are described in detail to illustrate the multifaceted nature of the way in which the software resources were used in lessons. Such a process of software deconstruction and resource integration in lesson plans has implications for all teachers of chemistry.

Keywords: visualisation software, conceptual understanding, chemical equilibrium, teaching strategies

Introduction

Conceptual knowledge of chemical equilibrium is considered fundamental to the understanding of many other areas of chemistry such as acid-base behaviour, solubility, oxidation, and reduction reactions. Reviews of NSW HSC examination reports (Weerawardhana, 2006) revealed that students have difficulties in solving conceptual questions about chemical equilibrium. These difficulties could be categorised into two types of lower performance: language difficulties interpreting the problem statement, and expressing (representing) their understanding; and inadequate factual, conceptual and procedural knowledge. Review of literature (Weerawardhana, 2006) has identified three major possibilities, which are likely to cause senior high school chemistry students' difficulties in learning chemistry/chemical equilibrium. These three are: the nature of chemistry itself, the methods of teaching chemistry, and the students' methods of learning chemistry.

Conceptual questions in chemistry require higher-order thinking skills or higher-order cognitive skills (HOCS) to invoke student's deeper understanding of chemical ideas (Huddle, 1998; Nurrenbern & Robinson, 1998; Zoller, Lubezky, Nakhleh, Tessier, & Dori, 1995). Many conceptual questions involve three forms of representations - macroscopic, sub-microscopic, and symbolic - to be used with chemical information (Nurrenbern & Robinson, 1998). Zoller et al. (1995), Zoller (2001), Zoller, Dori, and Lubezky, (2002) strongly suggest that traditional methods and instructional strategies of teaching chemistry are not adequate to attain conceptual learning and use of HOCS. According to Anderson et al. (2001), HOCS involve procedural and conditional (metacognitive) knowledge. The development of students' understanding from a procedural (knowing how) to a conditional level (knowing why) could be aided by linking chemical concepts at the macroscopic level with the symbolic and sub-microscopic levels of representation (Treagust, Chittleborough & Mamiala, 2003). In other words, HOCS make use of 'representational competencies' or the ability to comprehend inter-relationships among macroscopic, sub-microscopic, and symbolic representations and the ability to represent chemistry concepts in multiple ways (Kozma & Russell, 1997). The use of multiple representations in combination can support a more complete understanding of chemistry concepts (Burke, Greenbowe, & Windschitl, 1998; Sanger & Greenbowe, 2000) because students are able to formulate mental images (mental models) of an object or process at sub-microscopic level that is not physically perceived (Wiebe, 1993).

Theoretical background

In order to use and apply scientific understanding in a meaningful way students require better organised and deeper knowledge of basic concepts of science rather than having broader but superficial factual knowledge. Roth (1990) states that:

> Rich understandings of particular concepts and of the variety of relationships among them are also important cognitive tools, which are needed in order to create new meaningful conceptualisations. …meaningful conceptual understanding in science goes far beyond knowing facts and labels. Rather, conceptual knowledge becomes meaningful only when it can be used to explain or explore new situations (p.141).

Knowledge of chemistry is often communicated by using sub-microscopic representations such as molecular and structural formulae, stoichiometric reactions, ball-and–stick models, and bond-angles. Most sub-microscopic chemical representations are real, but too small to be observed. Therefore, much of the information about them is based on extrapolations of macroscopic representations - for example, sub-microscopic representations such as structural formulae, or the arrangement of atoms in molecules.

In chemistry, most concepts can be understood at the macroscopic, sub-microscopic, and symbolic levels. Johnstone (1993) places these three levels at the vertices of a triangle and emphasises that "every student studying chemistry for whatever purpose needs to operate within the triangle" (p. 703). The same view is presented by Bowen and Bunce (1997), who emphasise conceptual understanding in problem solving as the ability to represent and translate chemical problems using three forms of representations: macroscopic, sub-microscopic (particulate), and symbolic. Students' skills in translating among representations are often limited since their understanding (schema) is confined to surface features of a particular and familiar representational form; for example, different forms of a macroscopic representation such as colour, density and appearance (physical properties). Kozma and Russell (1997) stress that the development of representational competencies is important for students since "these skills can help students extend an understanding built on the surface features of a single representational form to one that is connected to other representational forms and includes underlying principles and concepts" (p. 964). Mahaffy (2004) adds another important aspect of understanding chemistry i.e. *human influence*. Understanding chemistry depends on the diverse influences of the society and living environment that shape the teaching and learning of chemistry.

> …Fundamental changes in the contours of chemistry as defined by new interfaces and research areas; changes in our understanding of how students learn, and how that applies to chemistry education; the wide-spread implementation of computer and information technologies to visualize complex scientific phenomena; and external forces, such as global concerns about energy and water resources and the environment, and the level of chemical literacy and public understanding of science (Mahaffy, 2004, p. 229).

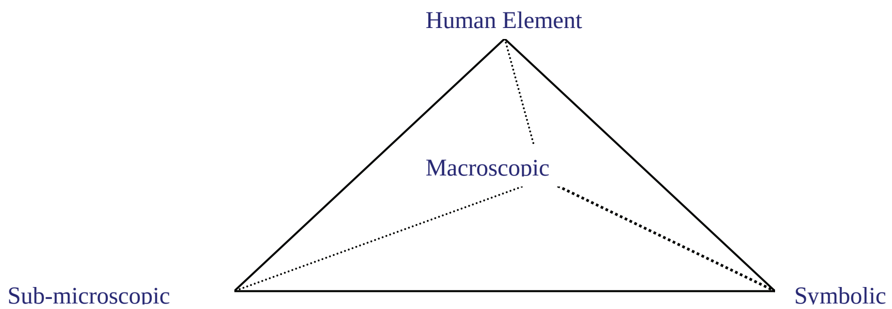

Figure 1: Tetrahedral chemistry education (Mahaffy, 2004, p. 231)

As a consequence of these influences the need for new dimensions of learning chemistry have emerged and these extend 'three-fold representations' of chemistry (Johnstone, 1993) to 'tetrahedral chemistry education' (Mahaffy, 2004) with the addition of the 'human element'. The tetrahedron model (see Figure 1) weaves conceptual knowledge of chemistry with its applications. Hence ***Conceptual understanding of chemistry*** involves conceptual knowledge, the ability to translate between and among different representations (representational competencies), and their use and application to explore new situations, and understand human influences and environmental events.

The study

The participants of the study were a group of eight pre-service science teachers, who engaged in two workshops, designed lessons then implemented them with 65 year eleven chemistry students from two schools. The first pre-service teacher workshop refreshed their knowledge of the topic of chemical equilibrium and allowed them time to use the software SMV: CHEM and VisChem. The second workshop challenged them to rearrange software interface elements to incorporate them into classroom teaching strategies that they would implement with the 65 year eleven students in the two local schools.

The pre-service teachers collaborated to design and implement their teaching strategies. They worked as small teams (Team A, B, and C) and were encouraged to use various combinations of resources from application software (including other software packaged with chemistry textbooks) with hands-on activities and chemical demonstrations.

Classroom observations, students' attitudes towards lessons, pre-service teachers' reflections and interviews were conducted to identify the impact of these teaching strategies on the professional development of the pre-service teachers.

Table 1: Pre-service teachers' use of different resources

Teams	Team A (2 members)	Team B (2 members)	Team C (3 members)
Application software	Word only	Word, PowerPoint, and Excel	Word, PowerPoint, and Excel
Physical analogies as demonstrations	Water boiling in a covered beaker illustrates the dynamic reactions of evaporation and condensation. Tennis balls used to show equal rates of dynamic reversibility. Two containers are joined with a plastic tube. When water is added to one container the level in both stabilises; used to explain Le Chatelier's principle. Seesaw analogy.	A glass 2/3 filled with water. Students act as water molecules and desks are arranged as a beaker to represent evaporation of water in an open and sealed beaker (simulation).	Preparation of soda water. Catching of golf balls (simulation). Sand put in and out of a big container at equal rates to show the steady state of the system (simulation). Escalator analogy.
Hands-on activities	Fe^{3+} / CNS^- experiment to illustrate Le Chatelier's principle.	Group activity with computer – Dynamic equilibrium task.	Group activity with computer experiment and animation.
Resources from SMV: CHEM		Animations, Dynamic graphs, Video segments.	Animation video segments and dynamic graphs.
Resources from VisChem	Water boiling animation.		
Resources from other chemistry software	Dynamic (animated) graphs to illustrate the results of Fe^{3+} / CNS^- experiment from software in textbooks.	Some diagrams and pictures from clip arts or websites	

Results

Pre-service teachers drew on a range of resources and methods to design their lessons, including graphics from related web sites or resources in any software they found relevant. Table 1 presents what software, physical analogies, hands-on resources and electronic resources (from software or elsewhere) the three teams of pre-service teachers incorporated in their lesson designs.

Each team took slightly different approaches to the topic of chemical equilibrium. Team A covered reversible reactions and Le Chatelier's principle and Team B covered the dynamic nature of chemical equilibrium and the effects of temperature and pressure on equilibrium systems. Team C covered phase equilibrium, properties of equilibrium and dynamic nature of chemical equilibrium.

Teaching strategies of three lessons are presented in Table 2. Most teaching strategies used the same sequence of instruction, same presentation methods and resources. Four teaching strategies in lesson one (highlighted in Table 2) were chosen to illustrate how pre-service teachers of Team A used different resources to integrate them into their lesson plan (see Figures 2 and 3). First two strategies linked hands-on demonstrations and students' group simulations to VisChem animations, and the 3rd and 4th strategies coupled experimental observations and analogies with dynamic graphs to explain Le Chatelier's principle.

Table 2: Teaching strategies of three lessons

Lesson	Part	Teaching strategy
1	1	1. Experimental observation linked to an animated model.
		2. Actions of animated model coupled with a students' simulation activity.
	2	3. Experimental observation linked to dynamic graph.
		4. Experimental observations and dynamic graphs coupled with two analogies.
2	1	5. The use of familiar examples to explain reversibility of reactions.
		6. Symbolic equations were linked to molecular-level animations.
		7. The use of videos of experiments, synchronous animation, and synchronous graph.
		8. Molecular-level animation linked to a simulation (students' activity).
	2	9. Video first and then video with animation.
		10. Changes in video linked with the changes in dynamic graphs.
		11. Different connections were made among different representations.
	3	12. Experimental video first and then combined with molecular-level animation.
3	1	13. Use of single representations first and then followed combined representations.
		14. Temporal changes of animation and dynamic graph linked to an experimental demonstration.
		15. Simultaneous use of synchronous actions of video, animated molecular model and dynamic graph.
	2	16. Analogies linked to simulations (students' activities).
	3	17. Mapping similarities and temporal changes of three similar systems: video and animation, and video, animation and symbolic representations progressively.
		18. Observations from video of experiment mapped with the changes of animation

Example 1: Part 1 of lesson 1 (Team A)

Organization of instruction

1 Experimental observations were illustrated using an animated model.
2 Changes in the animated model were explained with students' simulation activity.

Strategy 1

Students in small groups were asked to observe the similarities of both the animation and experimental demonstration at the same time. The experiment demonstrated how steam goes up and condensed water droplets flow down along the walls of the beaker.

Strategy 2

Students simulated the evaporation and condensation process using tennis balls as water molecules. Rolling of the same number of tennis balls along the floor in both forward and backward directions at the same speed and same time represented the constancy of product's and reactant's concentrations (but not equal) in an equilibrium system at any time. This also represented the equal rates of both forward and reverse reactions at equilibrium of $H_2O_{(g)} \Leftrightarrow H_2O_{(l)}$.

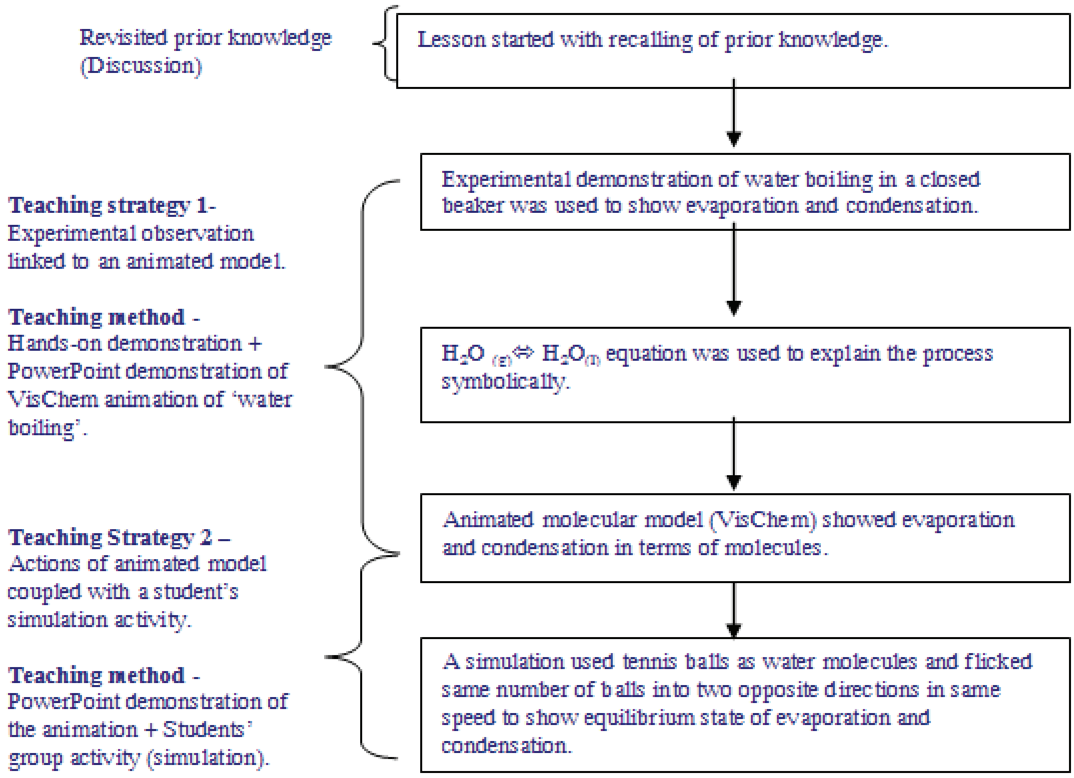

Figure 2: Example one

Summary of Team-A pre-service teachers' comments (from interviews and their reflections)
Recalling of students' prior knowledge and experience is important to connect new information into existing knowledge. Experimental demonstration, animation and simulation may help students to map different attributes such as surface similarities, temporal changes, and relations of the same process otherwise many aspects related to the sub-microscopic level cannot be perceived. If these students were presented only with the experimental demonstration with teacher's explanation (like traditional chemistry teaching) or only the animated molecular model with accompanying narration, or only the simulation, it would not make sense. Even though the molecules of the animated molecular model do not represent every feature such as exact shape, actual size, accurate bond angles, etc. of real water molecules, students may develop mental models that contain many of the attributes in relation to the physical equilibrium of water (evaporation and condensation process). The simulation activity, which involved students' actions, could further strengthen the mental models, which were already developed by the first strategy.
An increase in the number of representations may increase the understanding of different aspects or attributes of the same concept. For this purpose the presentation format of instructions and the use of different teaching methods (teaching strategies) appear to be crucial. For example, teaching methods such as students' simulation activities could increase student engagement and motivation. These strategies may provide students with more opportunity to construct their mental models of the equilibrium process.

Example 2: Part 2 of lesson 1 (Team A)

Organization of instructions
1 Experimental observations were illustrated using dynamic graphs.
2 Experimental observations and features of the dynamic graphs were illustrated using analogies.

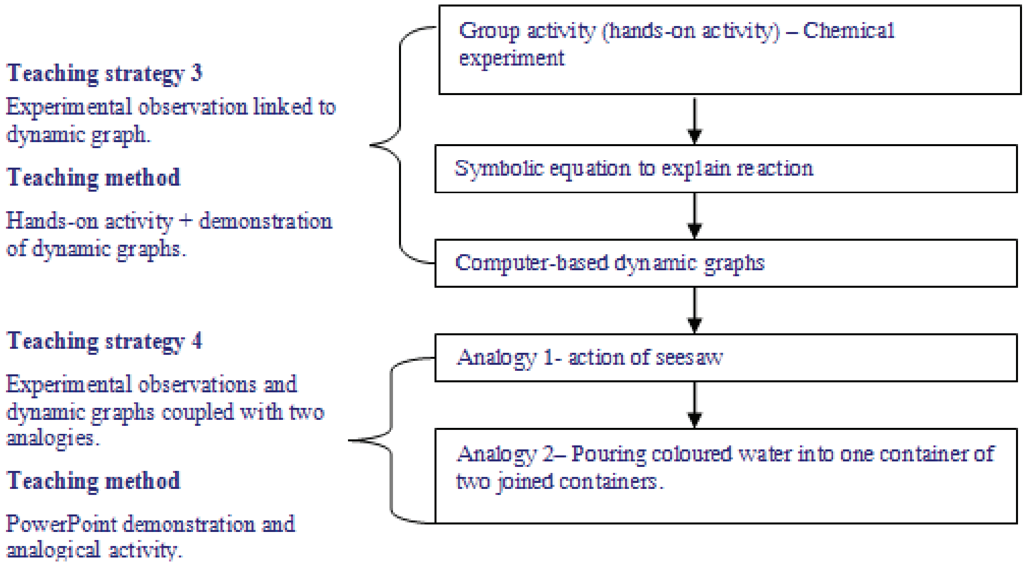

Figure 3: Example two

Strategy 3
After explaining the physical equilibrium (part 1 of lesson 1), the pre-service teachers (Team A) applied the knowledge of physical equilibrium to describe reversible reaction of chemical equilibrium and Le Chatelier's principle.
They used visible changes of the following reaction:
Fe^{3+} (yellowish) + 3 CNS^- (colourless) ⇔ $Fe(CNS)_3$ (deep red)
The students were in small groups (3-4 students) when completing the experiment. When CNS^- or Fe^{3+} is added to the system the red colour increased. The colour changes of the reaction mixture indicated respective changes in concentrations of reactants and products. Le Chatelier's principle was first explained using experimental observations and then the reaction equation, followed by the dynamic graphs from a CD-ROM packaged in a chemistry textbook.

Strategy 4
The pre-service teachers combined the experimental observations and the actions of dynamic graphs with two analogies to explain Le Chatelier's principle. The first analogy was the seesaw.

Summary of Team-A pre-service teachers' comments (from interviews and their reflections)
Since the reaction is very fast, students had difficulty in observing fast colour changes. Pausing the dynamic column graphs at three-second intervals that could show the fast reaction in slow motion. This helped students to see that fast reaction and the colour changes slowly. The changes in heights of three coloured columns indicate the respective concentration changes of two reactants and product.

The seesaw analogy can explain some aspects of Le Chatelier's principle, i.e., when reactants concentrations are changed the equilibrium is disturbed. During the second analogy, students added water into one container of two joined containers to show the same water levels after some time. This was explained as the system coming to a new equilibrium after adding coloured water (reactants) and its colour changed due to new concentrations of reactants and products. However, although these two analogies could show two or three different attributes of the real reaction system, all aspects related to Le Chatelier's principle could not be explained.

Discussion

As illustrated in the pre-service teacher reflections on the lessons they conducted with year 11 students, the combination of workshops, collaborative lesson design and team implementation helped to develop pre-service teacher awareness of the complexity of helping students to develop conceptual understanding of a core chemistry concepts. Pre-service teachers indicated the need for recall of prior knowledge, connection with student experience, the value of multiple representations, and the ability for minor defects in any individual representation (such as an animation or analogy) to be diminished as the number of representations or teaching strategies is increased. Multimedia resources could allow students to pause, replay and relate different representations and emphasise the dynamic nature of chemical equilibrium.

This increased awareness among pre-service teachers of the complexity of the topic, coupled with willingness to design multiple strategies to support student learning, could translate into a range of benefits for students. The year 11 students in this study valued the pre-service teachers' use of multiple representations (animations, video, and dynamic graphs) combined in various ways with analogies, physical simulation activities, and hands-on experiments. Although detailed data was not collected on student learning outcomes as a result of these brief lessons, the motivational benefits of the range of strategies was readily apparent.

Physical analogies linked to computer-based representations appear to play a motivational role in meaningful learning as they provide concrete references. Students reported that they felt they could understand 'chemical equilibrium' and therefore wanted to learn more. Analogies made highly interactive animated molecular models interesting to students. An analogy may relate new information or targeted molecular level information to students' real world experience. For this reason analogies can potentially promote conceptual change by helping students to overcome existing misconceptions or alternative conceptions of the dynamic nature of chemical equilibrium. Ideally analogies could help students recognise errors in conceptions they currently hold, reject those conceptions, and adopt new conceptions that are accepted by the scientific community.

Several strategies in one lesson could use many multiple representations in a flexible way that makes it easier to present different aspects of concepts. The sequence of strategies and the order of multiple representations complement information previously presented and reduce misinterpretations. For example, the first teaching strategy used experimental observations and an animated molecular model, which are two external representations that differ in the information each expresses, so that each representation denotes different aspects of the targeted internal representations (mental models) of reversible reactions in the physical equilibrium process. Empirical observations showed evaporation and condensation as a physical process, and the animated molecular model reduced possible misinterpretations of the physical process in terms of molecules. Symbolic representation combined the information from both empirical and sub-microscopic representations and communicated that knowledge. Empirical observations or animation alone would be insufficient to carry all the information about the physical equilibrium process or would be too complicated for students to interpret if it did so.

The second strategy used a simulation that supported and strengthened the targeted mental representations in the animated molecular model. Familiar or concrete simulation activity simply provided the same information in a different way, limiting misinterpretation of the animated model and therefore perhaps making internal mapping of similarities easier. Further, active engagement of students in simulation activity could increase attention and motivation. Since some information was common to the animation and simulation the simulation is partially redundant. This partial redundancy of information makes possible new interpretations about reversible reactions. Further, by distributing information over partially redundant representations, multi-representational learning environments can use less complicated representations. Since the knowledge about reversible reactions in terms of molecules was used, the third teaching strategy was complemented by the first two strategies.

In the fourth strategy some aspects of the experimental observations and the dynamic graph and the analogy were similar, therefore the analogy was partially redundant, but it limited misinterpretations of the dynamic graph and strengthened the targeted mental representations by facilitating comprehension.

By combining representations, students were no longer limited by the strengths and weaknesses of one particular representation. Therefore analogies combined with multimedia representations can play an important role in promoting meaningful learning by: organising information or viewing information from a new perspective; giving structure to information being learned by drawing attention to significant features of the target domain or to particular differences between the multiple representations and target domains; and visualising abstract concepts, or unobservable phenomena.

Conclusion

The pre-service teachers worked in small peer groups with the workshop facilitators, shared their understanding and had opportunities to obtain expert guidance. They were able to incorporate different representations (macroscopic, sub-microscopic, and symbolic) into teaching strategies with different combinations of other analogies and simulation activities to engage students in learning about chemical equilibrium.

Researchers report that most chemistry teachers rely on textbook information, but these pre-service teachers did not rely on textbooks – instead they used new teaching approaches and materials. They used computer-based technologies to couple software resources with physical analogies in teaching strategies that lead to a motivational learning environment and may have contributed to meaningful learning (conceptual understanding). Further data collection from students over an extended time period would be required to verify the extent of the development of their conceptual understanding. The planning of analogies and simulations was done in advance and the teachers provided rich explanations. They applied a variety of examples (multiple representations) that appeared to motivate students.

Pre-service teachers' knowledge construction was an iterative and collaborative process. By working in groups they developed accurate communication, shared meanings of words, negotiation skills, respect for others' ideas, and meanings of common words used in chemistry. They collaborated to design experimental set-ups and helped each other to understand how to use unfamiliar materials and apparatus.

We believe that the process of workshops, shared experimental design and classroom implementation allowed the pre-service teachers to more fully develop their conceptual understanding of chemical equilibrium. This form of professional development also helped them to be more aware of student learning difficulties in this area and to use the software resources in ways that targeted the specific needs of their students. Our interview transcripts from pre-service teachers and students indicates that this was an efficient and effective use of rich media elements in the software that targeted the specific learning needs of students. The process benefited pre-service teachers by allowing them to customise the media to suit their approach to teaching as well as to take into account the learning needs of their students.

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Student evaluations of elearning technologies in undergraduate psychology: A blended model for the future

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Undergraduate Psychology moved teaching materials from the school intranet to the University Learning Management System (*WebCT*) during 2005. This change took place to avail students of interactive, reflective and adaptive new elearning technologies. This blended learning approach allowed academics to both provide lecture materials online as well as add to the student experience. Specifically, this has been achieved through the complete redevelopment of learning materials for first year, the incorporation of online discussions – with a dedicated online tutor for second year, and online formative assessment for both first and second year units of study. 2,456 student evaluations of the functionality and educational components of the online units of study were analysed for first and second semesters in 2005. The results of this analysis will i) help determine the elearning materials which students desire and need, ii) influence the way we develop online components of units of study in the future, and iii) determine time and staffing commitments for the development of online resources.

Keywords: blended learning; interactive elearning; student evaluations; online tutor

Introduction

The development of flexible modes of delivery of all first and second year psychology units of study was undertaken at the University of Sydney in 2004/2005 to maximise the educational opportunities available to students. The School of Psychology moved materials off its intranet and developed online learning and teaching materials through the University Learning Management System, *WebCT*. In 2004 site shells were developed for first year psychology units of study (Psyc1001 and 1002) for a cohort of approximately 1200 students. In the following year the School received a grant from the University Teaching Development Fund (TDF) to develop this site shell further with the inclusion of additional content and educational design features. In order to provide the 2004 first year students with a continuing online experience in their second year of psychology, in 2005 the School received elearning project support from the University-funded initiative 'USyd eLearning' to develop unit of study site shells for its four intermediate units: Psyc2011 (Brain and Behaviour), 2012 (Statistics), 2013 (Cognition and Social Psychology) and 2014 (Personality & Differential Psychology), for a cohort of approximately 600 students. In addition, a solution was sought to manage the workload issues associated with online discussions, i.e. through the adoption of an online tutor for all second year units. The focus of the 2005 elearning developments across first and second year was, therefore, clearly different. Consequently this study's rationale for comparing first and second year student evaluations in 2005 was to assess the effectiveness of these different elearning initiatives in order to inform future online learning and teaching development.

The School of Psychology recognised that educational technology could be integrated with traditional forms of teaching to enhance the quality of learning and teaching for students (Pitman, Gosper, & Rich, 1999). The School also acknowledged the need to utilise the advantages of immediacy and accessibility of information provided through online flexible modes (Robinson & Shakespeare, 1995). Moreover, online modes have been shown to allow students to learn efficiently and effectively with minimal disruption to their life and work roles (Barnard, 1995). This is particularly important for the School's numerous part-time students, such as mature-age students and others who are employed full time. In addition, by introducing online interactive learning to complement existing face-to-face teaching, the School attempted to meet the blended learning objective of its Faculty: to offer students access to many flexible learning techniques, especially online resources.

In order to ensure the maintenance of a competitive edge with other psychology departments in Australia currently implementing extensive online learning facilities, the School realised it needed to make effective use of educational technology. Past research had revealed that in order to achieve a high level of effectiveness with online learning and teaching, materials needed to be reflective and adaptive, as well as interactive (Laurillard, 1993; Biggs, 2003). Interactivity was found by Alderman and Fletcher (2005) to be a defining characteristic of quality online learning. Sims (1999, p. 2) defined interactivity as ‘those functions and/or operations made available to the learner to enable them to work with content material presented in a computer-based environment’. Another focus of interactivity – that between students and academic staff – was nominated by Chickering and Ehrmann (1996) as the most important factor of their principles of good practice in undergraduate education which promote student motivation and involvement.

As it incorporated interactivity into quality online learning and teaching, the challenge for the School was to utilise efficient teaching practices which would maximise staff resources during times of increasing workloads. In first year psychology, the TDF grant enabled the appointment of a graduate student who could assist staff in developing content for interactive learning materials. In second year psychology, an online tutor was appointed to facilitate regular communication with students through online discussions. While online discussions can enable students to communicate amongst themselves in the form of online communities (Wenger, 1998), studies by Abas and Kaur (2004) and Cashion and Palmieri (2002) have found that students overwhelmingly direct their communications to the tutor, who they expect to be accessible and available to help them as needed.

The School also aimed to harness educational technology to assist students to become independent learners. Jones (1997) found that teaching innovation in the form of online curriculum material, self-paced learning and practical demonstrations encourage tertiary students to become independent learners who experience a range of learning and teaching modes. The new online components therefore include the following: a large number of online multiple-choice quizzes for students to practise concepts and skills and assess their understanding; interactive demonstrations that, for example, require students to carry out simple reaction-time experiments; and current video content to provide stimulus material for students to answer discussion questions. The video content supersedes the existing out-of-date material and provides vivid visual illustration of topic concepts. Taped interviews and dramatisations give students exposure to a wider range of current research opinions than those provided by existing video content.

In conducting student evaluations of the online learning and teaching materials, the School took note of suggestions by Oliver (2000) that evaluating new web technologies is often given a low priority in the development of such technology. More recently, studies at the University of Houston and the Learning Institute of Texas have been conducted to address this research limitation. Here Song and Kidd (2005) and Song (2005) have found that students’ level of interest in online learning and ease of locating information is affected by the organisation of information, site navigation and clear instructions. Quality of instructional design has also been found to be a key characteristic of student satisfaction in studies by Alderman and Fletcher (2005) and Cashion and Palmieri (2002). In order to build on this research, this study evaluated not only the educational process but also the process associated with the functional usability of elearning technology (Sheard & Markham, 2005).

The move to blended learning

First and second year psychology units of study approached the move from the school intranet to the Learning Management System in different ways. First year psychology innovations and developments included: i) a *WebCT* interface that was easy to navigate; ii) fourteen online multiple-choice quizzes (seven per semester) to assess students’ understanding of tutorial and lecture material as they progress; iii) ‘Flash-modules’ developed within the school and tailored to specific teaching requirements (e.g. report writing) and specific tutorials; iv) self-paced exercises that assess textbook material; including interactive demonstrations, flashcards, and labelling of diagrams.

Second year psychology innovations affected four units of study (Psyc2011, 2012, 2013, 2014) and included: i) the creation of a consistent set of unit of study website shells; ii) the incorporation of existing materials from the intranet into the site shells; iii) the development of a complete set of online components including discussion boards; iv) online quizzes for Psyc2012 and part of Psyc2013; and v) the training of an online tutor to moderate the four discussion boards. The online tutor was employed as staff expressed concerns about workload implications of the online communications tool. As a result, a single online tutor coordinated all four discussion boards in second year psychology.

It is important to emphasise that the approach, learning focus, allocation of resources and time taken for development of the units of study websites varied in first and second year psychology, and as a consequence differences were predicted in students' evaluations of the functionality and educational features of these blended learning initiatives. Because a greater focus and more resources were spent on the functional features of the online units of study for first year, these students would be expected to report stronger support for the navigational and organisational features than second year students. In a similar vein, because a greater emphasis was given to the online tutor and moderation of the discussion board, second year students would be expected to report greater support for these educational features compared to first year students.

Method

Participants

2,456 student evaluations of the online learning components from two first year, and four second year undergraduate psychology units were obtained across the two semesters in the 2005 academic year. Of the 1,701 first year responses, 68.36% were from female students, with a mean age of 19.44 (SD = 3.82). Of the 755 second year responses, 73.97% were from female students, with a mean age of 21.59 (SD = 5.27). 93.12% of the students were enrolled in their unit(s) full-time, and 87.67% primarily accessed their online learning materials from home.

Materials and procedure

Students completed the 'Student Evaluation of eLearning in Psychology Units of Study' (SEEPUS – see Appendix A) questionnaire at the end of each unit, as part of a battery of unit evaluation surveys. The SEEPUS was presented electronically through each unit's website, with first years completing it during their final tutorial class each semester, and second years in their own time at the end of each unit.

The SEEPUS was designed to assess student attitude towards the new *WebCT*-based online components for each unit, and their satisfaction with the integration of this new elearning content into their unit(s) as a whole. In addition to demographic questions, the SEEPUS contained two subscales specifically evaluating the functional and educational features of each unit's website. The four functional questions assessed ease of use, navigation, organisation and presentation, whereas the seven educational questions assessed the educational benefit received from the unit's website both as a whole and through specific elearning components (discussion forums, online lecture notes, and online quizzes). Students responded to each question on a 5-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'. Finally, an 'Overall Satisfaction' question (Q.17) was included where students responded to the question on a 5-point Likert scale, ranging from 'very poor' to 'very good'.

Results

Completion of the SEEPUS was not compulsory. In the first year units, where unit evaluations were completed during the final tutorial, 77.18% of enrolled students completed the questionnaire. Second year units, where students were asked to complete evaluations in their own time, saw a significantly lower response rate of 46.19% [$t(4) = 3.344$, $p = .029$]. Note also that the data are not always independent across units as many students were enrolled in multiple units. Students' answers could not be matched so as to run repeated measures analyses due to responses being anonymous.

Functional features

To assess student's evaluation of specific elements of their unit's website, analyses were grouped according to the two major sections of the SEEPUS – functional and educational features. Mean responses on the questions assessing the functional features of each unit's website are shown in Table 1.

Table 1: Means of student evaluations of 'functional features' of elearning technology

	Psyc1001 (*n* = 969)	**Psyc1002 (*n* = 732)**	**Psyc2011 (*n* = 216)**	**Psyc2012 (*n* = 115)**	**Psyc2013 (*n* = 257)**	**Psyc2014 (*n* = 167)**
Functional questions	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Q1.Easy to locate info on UoS website	4.07 (.87)	4.10 (.92)	3.93 (.78)	3.98 (.80)	4.02 (.78)	3.88 (.75)
Q2.UoS website was well organised & presented	4.11 (.76)	4.12 (.82)	3.89 (.75)	3.88 (.94)	3.86 (.77)	3.88 (.76)
Q3.UoS website was easy to navigate	4.00 (.78)	4.13 (.75)	3.86 (.78)	3.84 (.85)	3.91 (.81)	3.96 (.71)
Q4.UoS website was easy to use	4.07 (.74)	4.16 (.71)	3.97 (.65)	3.97 (.76)	4.00 (.75)	4.01 (.69)
Total functional features	4.07 (.68)	4.13 (.68)	3.91 (.63)	3.92 (.74)	3.95 (.70)	3.93 (.65)

Note. A mean score close to five suggests strong agreement with the statement; UoS = unit of study

Functional features across first and second year psychology

In order to test whether there were any differences in students' perceptions of the functional features of their unit of study websites across first and second year psychology, scores for the two first-year units (Psyc1001 and 1002) and the four second-year units (Psyc2011, 2012, 2013 and 2014) were collapsed. An ANOVA test revealed that first year students reported stronger agreement (M = 4.09, SD = .68) for the total functional features of their unit of study websites than second year students (M = 3.93, SD = .68), and that this difference was statistically significant [F (1, 2453) = 28.6, p < .001].

Functional features across semesters 1 and 2

Several one-way ANOVAs were also conducted to test whether there were any changes in students' perceptions of functionality between semesters 1 and 2. Analyses revealed that differences only existed in the first year cohort. Specifically, the analyses revealed that the second semester cohort of Psyc1002 students reported easier navigation [F (1, 1697) = 12.55, p < .001] and use [F (1, 1697) = 6.87, p < .01] of the websites than the first semester cohort of Psyc1001 students. There were no significant differences between first and second semester student perceptions of functionality amongst the second year cohort.

Educational features

Mean responses on the questions assessing the educational features of each units' website are shown in Table 2.

Educational features across first and second year psychology

In order to test whether there were any differences in students' perceptions of the educational features of their unit of study websites across first and second year psychology, scores for the two first-year units (Psyc1001 and 1002) and the four second-year units (Psyc2011, 2012, 2013 and 2014) were collapsed. Several one-way ANOVA tests revealed that second year students reported stronger support for the online tutor moderation [F (1, 2435) = 35.38, p < .001], online tutor posts [F (1, 2432) = 184.53, p < .001], online discussions [F (1, 2441) = 112.68, p < .001] , future elearning integration [F (1, 2443) = 38.47, p < .001], and total educational features [F (1, 2449) = 36.54, p < .001] of their unit of study websites than first year students. Student evaluations of the two first year units of study and the second year unit of study (2012) in which online quizzes were used throughout the entire semester reported stronger agreement that the quizzes assisted students' understanding than evaluations of the unit (2013) which only used quizzes for half the semester [t (2046) = 6.45, p < .001]. Post hoc (Bonferroni) analyses confirmed that the three units that did use quizzes throughout the semester did not differ significantly from each other on this question.

Table 2: Means of student evaluations of 'educational features' of elearning technology

	Psyc1001 (*n* = 969)	**Psyc1002 (*n* = 732)**	**Psyc2011 (*n* = 216)**	**Psyc2012 (*n* = 115)**	**Psyc2013 (*n* = 257)**	**Psyc2014 (*n* = 167)**
Educational questions	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Q10.Lecture-outlines helped me get more from lectures	3.93 (.93)	3.90 (.95)	3.95 (1.00)	3.49 (1.14)	3.95 (.90)	4.04 (.94)
Q11.Online tutor moderation motivated my involvement in discussions	3.17 (.81)	3.29 (.86)	3.33 (.95)	3.38 (.84)	3.45 (.91)	3.63 (.86)
Q12.Online tutor posts helped me make most of topics discussed	3.27 (.81)	3.34 (.82)	3.69 (.89)	3.75 (.93)	3.84 (.88)	3.92 (.84)
Q13.Online discussions helped me better understand key issues	3.20 (.81)	3.36 (.91)	3.51 (.84)	3.53 (.86)	3.71 (.90)	3.92 (.80)
Q14.Online quizzes helped me check my understanding of main ideas of learning tasks	4.10 (.85)	4.03 (.89)	–	4.09 (.88)	3.66 (1.01)	–
Q15.More elearning integrated in future Psych units	3.43 (1.02)	3.51 (.98)	3.64 (.88)	3.94 (.88)	3.67 (1.00)	3.80 (.89)
Q16.UoS website helped me get more out of my Psych studies	3.92 (.76)	3.94 (.77)	3.80 (.76)	3.92 (.81)	3.89 (.75)	3.92 (.70)
Total educational features	3.57 (.54)	3.62 (.55)	3.65 (.59)	3.72 (.55)	3.74 (.54)	3.87 (.55)

Note. A mean score of five suggests 'strong agreement' with the statement; UoS = unit of study

Educational features across semesters 1 and 2

Several one-way ANOVAs were also conducted to test whether there were any changes in students' perceptions of educational features of their unit of study websites between semesters 1 and 2. Analyses revealed that the semester 2 cohort of Psyc1002 students reported stronger support for online tutor moderation [F (1, 1685) = 7.43, p < .01] and online discussion forums [F (1, 1691) = 14.61, p < .001] than the semester 1 cohort of Psyc1001 students. Analyses also revealed that the semester 2 cohort of second year students (Psyc2013 and Psyc2014) reported stronger support for online lectures [F (1, 747) = 7.09, p < .01], online tutor moderation [F (1, 749) = 6.56, p < .01], online tutor posts [F (1, 748) = 6.16, p < .01], online discussion forums [F (1, 749) = 18.99, p < .001], and total education features [F (1, 749) = 7.47, p = .006] than the semester 1 cohort (Psyc2011, 2012). Overall, these results imply that in most instances student evaluations of the educational features of the websites improved with time, usage and familiarity.

Overall satisfaction with unit of study websites

Means of overall satisfaction with the integration of websites into their respective units of study (Q.17 of the SEEPUS) were compared between the two first-year units (Psyc1001 and 1002) and the four second-year units (Psyc2011, 2012, 2013 and 2014). First year students reported a slightly higher mean satisfaction (M = 4.17, SD = .70) than second year students (M = 3.96, SD = .71), and an ANOVA test showed this difference to be statistically significant [F (4, 2438) = 13.4, p < .001]. On average however, both cohorts perceived their unit of study website as 'Good'. There was very little difference in overall satisfaction levels between semesters 1 and 2.

Discussion

The School's adoption of Oliver's (2000) suggestion to evaluate new web technologies was found to be very fruitful. Not only have the research findings provided insights into the educational features of the unit of study websites which students find improve their learning, it has also highlighted the functional aspects of online learning which students find beneficial. The findings in this research support previous findings by Song and Kidd (2005), Song (2005), Alderman and Fletcher (2005) and Cashion and Palmieri (2002) that the quality of instructional design influences student satisfaction with online learning.

In addition, the advantages of interactive web technologies as proposed by Laurillard (1993), Biggs (2003), Alderman and Fletcher (2005), Sims (1999) and Chickering and Ehermann (1996) were also positively evaluated by students. The students demonstrated strong support for their interaction with a dedicated online tutor through online discussions, as well as computer-based interaction with learning and teaching material via online quizzes.

Functional features of unit of study websites

First year students reported significantly stronger support for organizational and navigational features of their unit of study websites than second year students. The single navigational pathways implemented, and the appropriate hierarchical organization of materials in first year may explain this finding. In addition the significant improvement in Psyc1002 students' perception of 'navigation' and 'use' in Semester 2 can be explained by the experience and familiarity gained through using the website in Semester 1. The implication of these findings for the School is that future blended models should invest time in developing the quality of instructional design aspects of unit of study websites.

Educational features of unit of study websites

Previous research has shown that online discussion boards have a significant potential to promote interactivity between students, in addition to that which occurs in the traditional tutorial room (Curtin, 2002). In an extension of this finding we found evidence that the implementation of a single online tutor to moderate online discussions and directly answer student course content related questions assisted students' reported learning for all second year units of study. More importantly, where online quizzes were incorporated into the unit of study websites (Psyc1001,1002 and 2012) students showed strong support for this form of interactive online learning (refer to Table 2). Moreover, Flash animations developed to increase interactivity and student understanding of concepts essential for first year psychology were also positively evaluated. These positive evaluations of the educational aspects of the websites imply that future blended models should invest time in developing content for interactive online learning and teaching materials, and employ an online tutor to moderate discussion boards for large groups of students.

Since we focused most funding on the development of online educational materials in first year, and on the online tutors in second year, our results reflect the positive impact of these elearning initiatives. Overall, student evaluations revealed that they felt that their unit of study website was a useful addition to traditional face-to-face teaching. In addition students were more than satisfied with the online components of their first and second year psychology unit of study websites, particularly those involving formative assessment, moderated discussions and well organised materials. These are important considerations for staff to take into account when designing online learning materials. Furthermore, the implications of these current findings for academics interested in implementing a blended approach to learning into their curriculum are that time and staffing are crucial to ensure students are learning. This may need to involve the establishment of teaching teams, including the appointment of online tutors for large cohorts of students, and the provision of dedicated staff (or time release for academic staff) to develop content for online learning materials.

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Appendix A

Student Evaluation of eLearning in Psychology Units of Study (SEEPUS)

Part A

Demographics

1. What is your age? ____________

2. What is your gender? ☐ Female ☐ Male

3. Please place a tick next to the unit in which you are enrolled:
☐ PSYC1001 ☐ PSYC2011 ☐ PSYC2012
☐ PSYC1002 ☐ PSYC2013 ☐ PSYC2014

4. Please place a tick next to your enrolment status:
☐ Full time ☐ Part time

5. Please place a tick next to the location in which you are most likely to access your unit of study website:
☐ Home computer ☐ School of Psychology ☐ University Location

Part B

Use the following scale to rate each of the statements below

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Functional Features
6. I found it easy to locate information on my unit of study website site.
7. My unit of study website site was well organised and presented.
8. My unit of study website site was easy to navigate around.
9. I found my unit of study website site easy to use.

Educational Features
10. The lecture outlines on the unit of study website helped me to get more out of my lectures.
11. The way the online tutors moderated our discussions motivated me to get more involved in the discussions
12. The posting of the online tutor to our discussions helped me to make the most of the topics discussed
13. The discussions on the unit of study website helped me better understand key issues we were studying.
14. The online quizzes helped me to check my understanding of some of the main ideas of our learning tasks
15. I would like more elearning integrated in Psychology units in the future
16. The unit of study website helped me get more out of my psychology studies this semester.

Overall Satisfaction
17. Overall, I would rate the integration of the unit of study website in Psychology as (please *circle* one):

1	2	3	4	5
Very Poor	Poor	Satisfactory	Good	Very Good

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Moving from face-to-face to online classrooms: The reflective university teacher

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This study explores the similarities, differences and possible interaction between two small groups of Canadian and Australian university teachers' face-to-face and online teaching approaches and philosophies. The paper compares their perspectives on teaching face-to-face and online at two comparable Canadian and Australian universities, both of which offer instruction in these two modes. Teaching philosophy data were gathered with the 'Teaching Perspectives Inventory' developed by Pratt and Collins at the University of British Columbia, which assessed participants' teaching approaches and philosophies in terms of their beliefs, intentions and actions in both modalities. The study upon which this paper is based builds upon a well established research partnership of the two authors who have previously explored emerging philosophies of learner centred teaching in distributed classrooms in Canada and Australia.

Keywords: philosophy of teaching, teaching perspective, theory of practice, cultural differences, face-to-face and online teaching, institutions of higher education

Introduction

Today's rapidly changing communication technologies are enabling, indeed pushing, teachers in higher education to move from traditional face-to-face classrooms to online classrooms. In order to make this transition successfully, they need to re-think their underlying assumptions about teaching, about the learning process and, most fundamentally, about their role as educators (Comeaux & McKenna-Byington, 2003; Garrison, 2006; McShane, 2006; Palloff & Pratt, 2000; Torrisi & Davis, 2000; Wiesenberg, 1999, 2002). This paper adopts Jarvis' (1999) concept of the 'reflective practitioner' and utilizes Pratt and associates' (1998) model of five teaching perspectives to describe the experiences of academics from two different countries (Canada and Australia) who are making this transition from teaching face-to-face to teaching online.

Jarvis (1999) conceptualizes the relationship between professional practice and one's personal theory of practice as a continuously evolving learning process, starting with the formulation of a personal theory that is initially untested (when a professional enters the profession), and then gradually moves towards a more complex meta-theory over time with a series of informal and formal learning experiences within the profession. Each time the personal theory is challenged with a new practical experience, it evolves and deepens conceptually. Underlying this process is the assumption that this meta-theory is driven by the demands of the profession, and that it becomes more complex and context-driven as it evolves over time.

Related to this idea of the evolving meta-theory of practice is Pratt's (1989) conceptualisation of increasing professional competence that occurs in three developmental stages: initial mastery of skills and procedures (in one's initial professional education or training); clinical problem-solving (in the novice professional's application of academic theory to actual professional practice; and critical reflection on knowledge and values (in the experienced professional's ongoing professional growth over the course of a professional career). The most important requirement for reaching this third developmental stage is the conscious and intentional interaction between critical thought, professional practice, and professional philosophy or ideology. Pratt and associates (1998) conceptualize one's theory of practice within the profession of teaching as a 'teaching perspective' or inter-related set of beliefs and intentions that directs a teacher's classroom practice.

The importance of having a clearly articulated philosophy or approach to teaching has been a focus in the teaching literature for over two decades (Elias & Merriam, 1980, 2005; Jarvis, 1999; Mott, 1996; Zinn, 1998). Elias and Merriam's 1980 seminal publication on this topic (now in its third 2005 edition) became an important text for educators engaged in training teachers of adults over 20 years ago (Wiesenberg, 1999). Elias and Merriam believe that "the knowledge of philosophy of education …distinguishes a professional educator from a paraprofessional or a beginning teacher" (Elias & Merriam, 2005, page 11). They carefully delineate seven distinct perspectives on the teaching/learning process grounded in western European and North American concepts of the teaching/learning process.

Mott (1996) calls this process of consciously and continuously reflecting on the challenges of practice as "reflective theory building". Her rationale is simple – having a clearly articulated 'theory of practice' enables one to more successfully address the constantly changing and uncertain nature of professional practice. Grounded in Schoen's multi-dimensional model of reflection in practice, Mott describes this process as starting with problem posing, moving onto data gathering, acting on new knowledge, evaluating one's new actions, and then sharing new knowledge with colleagues. Jarvis' (1999) concept of the 'practitioner-researcher' comes very close to this description, with the additional element of meta-theory development over time within a continuous and life-long learning cycle.

Inevitably, these discussions gave rise to attempts to facilitate this transfer of theory to practice, beginning with the development of various instruments to measure one's philosophy or perspective on teaching (Pratt and associates, 1998; Zinn, 1998). Originally as part of her doctoral dissertation, Zinn (1998) developed a commercially available instrument called the 'Philosophy of Adult Education Inventory' based on Elias and Merriam's initial five philosophical perspectives. At about the same time, Pratt and colleagues (1998) developed an instrument called the 'Teaching Perspectives Inventory' (TPI) which was grounded in North American concepts of the teaching/learning process, but validated cross-culturally in China, Hong Kong, Singapore, Canada and the United States. It is available online for research purposes only.

This paper discusses the teaching perspective preferences expressed by university teachers from two different cultures who teach in both face-to-face and online classrooms in comparable institutions of higher education, the similarities and differences between their Teaching Perspective Inventory scores by modality, and the significant correlations between these scores within each modality. The paper concludes with a discussion of the importance of reflection on one's teaching philosophies when shifting from a traditional face-to-face classroom context to a virtual classroom context. Some directions for future research on this important issue are offered, as more and more institutions of higher education offer online programs cross-globally and demand that teachers make this shift.

By exploring the multiple interactions between face-to-face and distributed teaching philosophies, as well as differences and similarities in teaching philosophies between cultures, the authors hope to add to the growing body of knowledge about teaching pedagogy in general, and about the transitions that occur philosophically when moving from traditional face-to-face classrooms to virtual classrooms within institutions of higher education within these two cultures in particular.

Method

The study used a mixed qualitative (data collected with an open-ended survey) and quantitative (data collected with the TPI) case study approach (Stake, 2002) with each university acting as a separate case providing data from two different cultural contexts. This paper discusses the results of the quantitative TPI data analysis only. Discussion of the qualitative data collected in the survey is discussed elsewhere (Stacey &Wiesenberg, 2006).

The Teaching Perspectives Inventory (TPI), which was developed and validated by Pratt and Collins (Pratt & associates, 1998), measures teachers' orientations to their roles as managers of the learning process (Pratt & Collins, 2006). The 45-item Likert-type inventory yields five alternative points of view (or perspectives) on teaching by asking structured questions about their actions in the teaching setting, their intentions as to how they organize the learning situation, and their beliefs about fundamental principles of teaching and learning. These five perspectives are: Transmission (lecture and teacher-centred); Apprenticeship (experiential and coaching-oriented); Developmental (facilitation and learning-centred); Nurturing (focused on building learners' self-esteem); and Social Reform (focused on changing students' beliefs and actions-oriented). The TPI also yields three sub-scores within each perspective called Beliefs, Intentions and Actions which assess these three elements within each perspective, as well as consistency across each perspective (the TPI can be accessed at www.teachingperspectives.com).

This conceptual model of teaching adults was developed for face-to-face teaching contexts with over two decades of research in Canada, China, Hong Kong, Singapore, and the United States. Pratt & associates (1998) interviewed more than 250 teachers in different settings about what 'teaching' meant to them (i.e. their beliefs), observed their teaching (i.e. their intentions), and evaluated it in terms of how they reached their teaching goals (i.e. actions). One of the sub-goals of this study was to test whether or not the TPI was able to assess respondents' philosophies about teaching online as well as face-to-face, and to see if it could distinguish between teaching philosophies that are generally quite different in these two modalities.

In this study, participants were asked to complete the TPI twice, once from their perspective on face-to-face teaching and then again from an online teaching perspective. Half of the participants completed the TPI with their face-to-face teaching in mind first, while the other half completed it with their online teaching in mind first in order to reduce an 'instrument familiarity' response bias. Using paired *t*-tests, these 2 sets of TPI scores (one for each modality) were analysed for similarities and differences between perspectives by teaching modality, as well as by university (i.e. culture).

Participants

University of Calgary
The University of Calgary at 40 years old is a relatively new single-campus post secondary institution located in a large western Canadian city offering primarily face-to-face classes on campus. It is only within the past 10 years that a few of its 15 faculties have been offering degree programs in a distributed format. Recently the university has made a strong commitment to offering distributed classes and technically supports this by utilising the computer conferencing system called Blackboard, enhanced with the audiovisual conferencing system called Elluminate Live. In 2005 there were almost 28,000 students studying full or part time at the University of Calgary, the vast majority attending on campus classes.

The Faculty of Education evolved from Calgary's Normal School for teacher training that was originally established one hundred years ago. Today this Faculty offers more distributed programs than any other in the University of Calgary, primarily to a mature student group consisting of working professionals who access these programs online on a non-residential and often part-time basis typically on weekends and evenings.

Participants in this study were all tenured or tenure-track full-time academics drawn from two of the three divisions within the Faculty of Education, the Graduate Division of Educational Research and the Division of Applied Psychology. They teach in several course-based masters level programs ranging from Workplace and Adult Learning to Counselling. They also teach in two course-based doctoral programs in Educational Leadership and Higher Education Administration. Twelve of the potential pool of 70 faculty invited to participate because they teach both face to face and online (representing a response rate of 17%) returned two sets of TPI scores, one for face-to-face and one for online teaching contexts. Nine were female and three were male, teaching an average of 4.73 half-courses per academic year, with 47.09% of these courses face to face and 52.09% online. The average face-to-face class size for this participant group was 20 students, while the average online class size was 18.5 students. Nine of the 12 participants were teaching primarily online courses, which are generally smaller than face-to-face classes.

The course load for Faculty of Education academics is 5 13-week courses per academic year unless one holds an administrative role, which generally results in a reduced teaching load. This small group of participants had taught an average of 19.3 years face-to-face, and 6.3 years online, and could be described as 'early adopters' of online teaching who chose to teach online out of a professional interest in moving to this modality. They held an overall positive attitude towards the use of advanced communication technologies and stories of how it had enhanced many aspects of their teaching role were reflected in the qualitative data collected from the surveys.

Deakin University
Deakin University was incorporated in 1975 and has a longer history of distance education; since the early 1990s it has been a multi-campus university with two capital city campuses as well as three regional campuses in Victoria with a reliance on a university wide infrastructure for information and communication technologies. The university offers the same programs on and off campus, using the Learning Management system, WebCT, as a basis for its online system called Deakin Studies Online, which also provides other forms of electronic communication with the possibility of synchronous audio and text communication through Elluminate Live and other media. Since 2002 there has been a policy of required online presence for all subjects, with some courses using interactive online technologies. All undergraduate students now take one subject in their degree completely online to prepare them for graduate level professional development which is offered only online learning. In 2005 there were 32,354 students enrolled at Deakin University, with 20,940 on campus students and 11,414 off campus students enrolled in the Faculty of Education.

The ten participants in this study were from the Faculty of Education and were selected to include teachers who taught both online and face-to-face classes. They taught in the main undergraduate teacher education studies major program, in a range of teaching method areas including mathematics, science education, physical education, literacy and information technology. All had some experience teaching online at the postgraduate level in courses catering to the professional education of teachers in all subject areas in schools, as well as courses in teaching in higher education (two participants) and in teaching English as a second language (one participant). The participants were primarily based at the metropolitan campus of Deakin where the largest proportion of face-to-face education classes (mainly undergraduate) are held. Most postgraduate teaching in the faculty is done online and six of the teachers in this sample were reflecting on their experiences of graduate level online teaching.

Five participants were female and five were male, teaching an average of 7.8 thirteen week long courses per academic year, with 52.89% of these courses face to face and 37.8% online. The average face-to-face class size for this participant group was 26.7 students, while the average online class size was 21.8 students. The average teaching load for Faculty of Education academics is eight courses per academic year unless their administrative or research role reduces this teaching load. They had taught an average of 24.8 years face-to-face, and 4.9 years online, and could be described as ‘new adopters’ of online teaching with a stronger orientation to face-to-face teaching than to this new modality. Five of the participants had just begun teaching a fully online unit to on campus undergraduate students for the first time and held ambivalent attitudes about Deakin’s new policy of integrating online communication technologies with face-to-face teaching. This attitude is reflected in some stories of difficulties adapting to this new teaching context in the qualitative data collected from the surveys.

Discussion of findings

The findings of the data analysis are discussed in terms of participants’ five TPI main scores (indicating teaching preferences) for face-to-face and online classrooms, and significant correlations between the five TPI main scores and overall sub-scores. Findings for the total group of participants from both universities, as well as for each group of participants from each university are discussed when appropriate.

TPI main scores and sub-scores
Paired *t*-tests on main TPI scores revealed that participants’ teaching preferences were remarkably similar across both modalities, as well as for both universities. There were no significant differences between four of the five teaching preferences, while the Social Reform TPI scores (the lowest for both participant groups) were significantly higher for the University of Calgary group than for the Deakin University group ($t=2.25$; $p<0.05$; see Table 1).

The University of Calgary participants’ strongest teaching preference for both modalities was Developmental, followed by Nurturance and Apprenticeship (tied in face-to-face classrooms), then Transmission, and Social Reform which was significantly lower as the fifth preference. Deakin University participants’ strongest teaching preference for both modalities was Developmental, followed by Apprenticeship, Nurturance, Transmission, and Social Reform (significantly lower than the other 4, as well as the University of Calgary group).

Table 1. Independent-samples *t*-test results for TPI scores by modality and university

TPI	University	*N*	Mean	Standard Deviation	*t*	*Df*	Sig. (2-tailed)
Online-Tr	UofC DU	12 10	31.75 31.10	4.77 4.68	.32	20	.75
Face to face-Tr	UofC DU	12 10	31.50 30.20	4.34 4.26	.71	20	.49
Online-Ap	UofC DU	12 10	36.00 34.90	3.54 5.17	.57	20	.58
Face to face-Ap	UofC DU	12 10	35.75 36.90	4.07 4.43	-.63	20	.54
Online-Dv	UofC DU	12 10	37.75 38.20	3.28 3.65	-.30	20	.77
Face to face-Dv	UofC DU	12 10	38.00 37.80	3.74 4.05	.12	20	.91
Online-Nu	UofC DU	12 10	36.67 34.60	4.23 4.55	1.10	20	.29
Face to face-Nu	UofC DU	12 10	35.75 35.80	3.28 5.55	-.03	20	.98
Online-SR	UofC DU	12 10	30.00 25.30	6.28 3.27	2.25	20	.04
Face to face-SR	UofC DU	12 10	30.33 25.70	6.71 5.12	1.84	20	.08

The finding that teaching preferences did not differ significantly for these two modalities is inconsistent with the research literature that describes considerable differences in teaching approaches between face-to-face and online classrooms for those teachers who have successfully made this transition (Comeaux & McKenna-Byinton, 2003; Palloff & Pratt, 2000; McShane, 2006). A small but growing body of largely anecdotal literature describes teaching beliefs and actions that contain aspects of Pratt's Developmental/Apprenticeship/Nurturance perspectives as more effective in online classes than the traditional teaching beliefs and actions that contains aspects of Pratt's Transmission perspective, which is typical of many institutions of higher education that offer primarily face-to-face programs (Garrison, 2006).

The finding that Social Reform is the least preferred teaching preference for Canadian teachers is consistent with the literature that describes this perspective as standing "outside the mainstream of educational philosophy" in North America (Elias & Merriam, 2005, p 147). Rather, this literature describes strong underlying 'nurturing' and 'socially supportive' teaching beliefs and actions in North American institutions of higher education. The finding in this study that the Canadian Social Reform scores were significantly higher than the Australian Social Reform scores may be explained by the fact that this Canadian group of teacher teach graduate level classes only, which tend to emphasize a more critical analysis of the literature and its application than do undergraduate classes, which made up half of the Australian participant groups' teaching load.

The fact that the TPI main scores were not significantly different by modality may be explained by the possibility that this tool, developed for face-to-face teaching contexts, cannot accurately assess teaching philosophies for online teaching contexts. The authors' analysis of the TPI items indicates that some of the 15 'action' items may be applicable to face-to-face teaching contexts only. The authors' analysis of the survey data did reveal apparent differences in participants' teaching perspectives in these two modalities, as well as a great deal of conscious application of their newer online teaching approaches to their face-to-face teaching contexts (Stacey & Wiesenberg, 2006). It is possible that the study participants' responses reduced any real differences between their face-to-face and online beliefs, intentions and actions due to TPI items that were not developed to take differences in these two modalities into account.

The initial paired *t*-tests of TPI sub-scores revealed a significant difference within the 'Action' sub-score indicating that what the two participant groups actually did within their classrooms differed. Further analysis revealed three distinct sub-scores differences between the two participant groups (see Table 2). The University of Calgary participants appeared to be significantly more 'nurturing' in their actions online than were the Deakin University participants, as well as significantly more 'social reform' oriented in their actions in both face-to-face and online classrooms.

Table 2. Independent-samples *t*-test results for TPI sub-scores

TPI	University	*N*	Mean	Standard Deviation	*t*	*Df*	Sig. (2-tailed)
Nu-Online-Action	UofC DU	12 10	11.83 9.90	1.95 2.18	2.17	20	.043
SR-face to face-Action	UofC DU	12 10	9.92 7.80	2.57 2.15	2.10	20	.048
SR-Online-Action	UofC DU	12 10	9.42 7.80	2.31 1.40	2.02	20	.058

This finding is consistent with the discussion of the TPI main scores above, perhaps pointing to cultural differences in teaching beliefs and intentions between the two participant groups. The authors' experiences within both cultures indicates that North American teachers tend to believe that building students' self-esteem is the key to successful classroom learning, while Australian teachers, particularly in teacher education, focus more strongly on developing students' construction of their own knowledge. Australian teachers' communication style is often perceived as more direct, with fewer overt affective references, which can be interpreted as less nurturing than North American teachers' communication style. Though the affective aspect of teaching is considered important, it may be communicated differently in both face-to-face and online classrooms.

Correlations between TPI scores and sub-scores

All of the five teaching preference main scores for teaching in both modalities were strongly inter-correlated for the total participant group. This was expected given that there were no significant *t*-test differences by modality or by university on these TPI scores (except for Social Reform). Specifically, moderate to strong correlations were found between:

- online Developmental and face-to-face Transmission (.51; p>.05)
- face-to-face Developmental and face-to-face Social Reform (.49; p>.05).
- face-to-face Transmission and face-to-face Developmental (.48; p>.05)
- face-to-face Transmission and face-to-face Apprenticeship (.56; p>.01)
- online Transmission and online and face-to-face Apprenticeship (.63; p>.01; .63; p>.01)
- online Apprenticeship and online and face-to-face Developmental (.58; p>.01; .63; p>.01)
- face-to-face Apprenticeship and face-to-face Developmental (.72; p>.01)
- online and face-to-face Nurturance and face-to-face Social Reform (.45; p>.05; .50; p>.05)

The moderate correlations between the Developmental and Apprenticeship perspectives for both modalities make theoretical sense, given that the underlying key philosophical assumptions for these approaches are conceptually complementary (Pratt & associates, 1998). Both are grounded in a 'constructivist' learner-centered and active epistemology of learning and consistent with literature describing effective online teaching approaches (Garrison, 2006; Palloff & Pratt, 2000; McShane, 2006). The fact that this correlation was evident for teaching in both face-to-face and online classrooms indicates that these participants' beliefs, intentions and actions appeared to be consistent regardless of the modality in which they were teaching. The moderate correlations between Transmission and Apprenticeship perspectives also makes theoretical sense, given that apprenticeship teaching contexts often require explicit instruction making a combination of these two approaches complementary in teaching situations requiring the application of theory to practice. These participants, teaching in professional faculties of education, would have a strong 'application of theory to practice' orientation to their teaching with a great deal of modelling and 'expertise' underlying their classroom practices regardless of modality.

The moderate correlations between Developmental and Transmission, as well as between Development and Social Reform perspectives appears to be inconsistent with the literature on teaching philosophies generally (Elias & Merriam, 2005; Zinn, 1998) or effective teaching approaches in online classrooms in particular**.** These findings may reflect the Deakin University groups' somewhat newer status to online teaching, as they may be 'in transition' from familiar traditional face-to-face teaching approaches (typically more transmission-oriented) to less familiar online teaching approaches (typically more developmentally/nurturing-oriented). The Developmental-Social Reform correlation may reflect the larger University of Calgary groups' postgraduate level teaching load which generally focuses on a more critically analytical approach to theory and its application to practice.

The moderate correlations between the Nurturance and Social Reform perspectives is not consistent with the literature on effective teaching approaches generally, or with teaching in online classrooms in particular. Again, this may reflect the larger University of Calgary groups' graduate level teaching load, which would combine a North American nurturing perspective with a Social Reform orientation.

Across all five teaching perspectives there were a number of noteworthy significant correlations between the three sub-scores for the total participant group, indicating that for the most part, beliefs, intentions and actions were all consistent. The finding of no significant correlations between online beliefs and online actions is consistent with the *t*-test results for three TPI Action sub-scores (see Table 2). This finding is interesting in light of the moderate correlations between the five TPI main scores discussed above. If this combined group of participants held consistent beliefs, intentions and actions in terms of their teaching approaches, the literature, and the authors' experiences, would predict that Developmental, Apprenticeship and possibly Nurturance (in North American teachers) main scores would be correlated. While this was true for the two former, there were no significant correlations between the Developmental and Apprenticeship and Nurturance. On the other hand, the literature and the authors' experiences would predict that Transmission and Social Reform main scores would be correlated, given that both of these approaches are grounded in a 'teacher-centered' and more passive epistemology of teaching (Pratt & associates, 1998). This was not true, perhaps reflecting the 'in transition' status of the Deakin University group of participants in particular.

Conclusions

This study's findings present an interesting and intriguing picture of the teaching preferences of two small groups of teachers in two culturally different settings, and within two different teaching modalities. On the one hand, the many similarities between these two groups may indicate that these two groups hold remarkably consistent beliefs about their teaching across cultures and for both face-to-face and online teaching contexts. Or, it may indicate that the TPI, developed to assess face-to-face teaching perspectives, was unable to distinguish between teaching perspectives within face-to-face and online teaching contexts. It may be that the tool requires revision in order to be sensitive to the sometimes subtle shifts in beliefs, intentions and action required to make a successful transition from face-to-face to online classrooms. Or, it is possible that this tool's underlying conceptual framework, developed over 10 years ago, does not fit with current thinking about effective online teaching and learning processes.

The few significant differences between these two groups may indicate true cultural distinctness between Canadian and Australian philosophies of teaching in institutions of higher education. The presence of true cultural differences between these two groups in terms of having a 'nurturing' versus 'knowledge building' focus to one's teaching approach in particular requires further study. Another possible explanation for the apparent different orientations to these two teaching contexts may be due to the two cultural groups' varying amounts of experience teaching in online classrooms. It is also possible that the differences in class sizes demanded a higher frequency of Deakin teacher pedagogical responses, which may have translated into less time for 'nurturing' from this group.

In terms of Jarvis and Pratt's concept of having a continually evolving philosophy of teaching, the practitioners in this study did not have a period of time in which to reflect on their teaching approach in the two different modalities because they completed the TPI for each of these teaching contexts in one short time period. While the TPI has been demonstrated to be an effective tool for promoting reflection on one's teaching philosophy (Hubbal, Collins & Pratt, 2005) with a group of 44 university teachers, the study took place over an extended period of time within a structured faculty development program. While no significant differences between the five TPI perspectives were apparent at the beginning of this program, significant differences did emerge at the end, suggesting that their philosophies did indeed evolve over time.

Overall, the findings of this small and exploratory study clearly indicate a need to further explore the reasons for both the similarities and differences revealed between these two cultural groups of participants teaching within two different teaching modalities. Further investigation into the relevance of the TPI as a tool for assessing teaching perspectives, as well as promoting reflection on one's perspective, within online classroom contexts is also indicated.

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Bionotes

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The Lectopia service and students with disabilities

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The Lectopia lecture capture and publication system was introduced to The University of Western Australia in 1999. Since this time the project team has regularly received feedback from students with disabilities or medical conditions, as well as from the University's Diversity Projects Office, regarding the positive impact Lectopia has had on their learning activities. Throughout the project's history the feedback received from these two groups, predominantly provided informally, has helped to shape the system's development. In 2006 the team undertook to conduct a thorough analysis of why and how students with disabilities or medical conditions are using Lectopia, the perceived benefits derived and the problems encountered. It is anticipated that results from this analysis will further assist the project team to refine the system to ensure it continues to meet the needs of the University's diverse student population.

Keywords: lecture recordings, students with disabilities or medical conditions, accessibility

Background

The practice of recording audio and video material from university lectures to make them available online for students to access has been repeatedly acknowledged as having significant benefits for a large proportion of the student population (Laurillard, 1993; Bligh, 2000; Biggs, 2003). Students with learning styles not necessarily suited to the face-to-face lecture method, students with disabilities or medical conditions, international students, and those with significant work or domestic pressures have overwhelmingly welcomed the opportunity to gain access to lecture recordings online (Williams & Fardon, 2005). Once a lecture is recorded, students are empowered with a greater level of control over the material presented, allowing them to review the material at their own pace and in an environment in which they are comfortable, as many times as they require.

Lectopia (formerly known as the iLecture System) is a lecture capture and publication system which has been in production at The University of Western Australia (UWA) since 1999. The system facilitates the automated recording of audio and video material from lectures for delivery to students via the internet. The impacts on the lecturer are minimal, and students are able to access lecture recordings in a variety of streaming and download formats, as well as via podcasting. The main driving force behind creating Lectopia was the desire to make lectures more accessible to the increasingly diverse student population, and this remains a high priority for the project team. At UWA in semester one 2006, Lectopia was installed in 45 venues and recorded over 400 lectures per teaching week: more than 5,000 lectures across the semester. By the end of the examination period, these recordings had received almost 300,000 hits from students.

Study introduction

In a study carried out by the Australian Senate, it was noted that advances in technology have resulted in assisting students with disabilities in gaining greater access to higher education. Particularly mentioned was the importance of improved flexibility and access to information achieved through technology, resulting in enhanced levels of independence and better opportunities for academic success (Employment, Workplace Relations and Education References Committee, 2002). Lecture recording systems are an example of such technology.

In literature dealing with issues relating to learning in higher education and students with disabilities or medical conditions, the practice of recording lectures (and/or other teaching materials) is frequently proposed as beneficial to advancing learning (Exley & Dennick, 2004; Leung et al., 1999; Skill: National Bureau for Students with Disabilities, 2004, 2005). A quick glance through university websites in Australia and the UK endorses this approach, repeatedly recommending that staff consider recording lectures for students with disabilities who may be attending their lectures (Australian National University, 2005; Monash University, 2003; University of Adelaide, 2005; University of Cambridge 2004; University of Cardiff, 2005). Of particular note is the University of Newcastle's Disability Support Services website which provides information sheets for staff on 21 different disabilities from ADHD to Vision Impairment; every one of these information sheets contains the recommendation that lectures should be recorded (University of Newcastle, 2005). These university websites state that recording lectures alleviates the pressure on students with disabilities to take notes during a lecture, provides an avenue for the efficient review and revision of core course material, and is an important resource should regular attendance at the face-to-face lecture not be possible due to a medical condition.

In 2005 at UWA, 902 undergraduate students recorded on their (re-)enrolment form that they had either a disability or a medical condition. This is almost 7% of the undergraduate population at the University. The disability condition types listed on the enrolment form are learning, hearing, vision, mobility, medical and other. Learning (10%), mobility (7%) and medical (31%) have the highest proportions of respondents, although it should be noted that students were not required to provide this information and that the number of 'unknown' disabilities or medical conditions was considerable (31%).

At UWA, the tradition of recording lectures is now firmly established as a means for providing flexible access to lecture materials for students with disabilities, although attendance at face-to-face lectures where possible remains an expectation of all students. This is evinced through a variety of University documentation; for example, a report published by the University's Disability Services observed the importance of lecture recordings in supporting a diverse student population (University of Western Australia, 2003) and the annual *Study at UWA* publication for prospective students lists lecture recording as one of the main services provided to students with disabilities or medical conditions to assist their learning activities (University of Western Australia, 2006).

Despite lecture recordings being viewed as an important learning resource at UWA for students with disabilities or medical conditions, to date our only evidence of this has been taken from informal or anecdotal feedback, and through campus-wide Lectopia surveys which have occasionally elicited general information or comments about the use of the system from students with disabilities. Therefore, the purpose of conducting a Lectopia study specifically targeted at UWA students with disabilities and medical conditions was to capture more substantial information about their use of lecture recordings at UWA: why they are using the system and what value they attach to having lecture material available online; and how they are accessing the lectures, in particular if they need to use specific software tools such as Jaws, Dragon or Zoom Text to gain access. This study will offer the UWA Lectopia project team, together with the UWA Diversity Projects Office, the opportunity to better understand the use of lecture recordings by students with disabilities to feed back into both the Lectopia system development and the University's policies and procedures for supporting the learning needs of students with disabilities.

Study summary

The central activity of this study was to conduct a survey about the use of lecture recordings across all undergraduate and Masters by Coursework students who have acknowledged either a disability or a medical condition on their enrolment form. The survey was constructed by the UWA Lectopia project team in collaboration with the UWA Diversity Projects Office.

This survey was conducted over a three-week period at the end of semester one 2006 (10–28 July), with survey questions covering the following topics and issues:

- type of disability as acknowledged on UWA enrolment documentation
- tools used to access recording
- preference for delivery format
- frequency of attendance at live lectures
- frequency of access to lecture recordings
- reasons for using lecture recordings
- opinion of the value of lecture recordings as a learning resource
- problems encountered when accessing recordings
- suggestions for improvements to the service and for new features.

A printed copy of the survey was sent by the Diversity Projects Office to 578 UWA undergraduate students and 57 Masters by Coursework students, with an additional 7 undergraduate students being sent an online version of the survey via email. 642 students in total were sent the survey.

Following on from this targeted survey for students with disabilities and medical conditions, a campus-wide Lectopia survey was conducted over a three-week period during semester two 2006 (28 August–15 September). All UWA students accessing lecture recordings during this period were given the opportunity to complete an online survey about their use and experience of Lectopia. This survey seeks information about demographics, type of equipment used to access recordings, lecture attendance, and use and experience of Lectopia. This general survey does not seek specific information about students with disabilities or medical conditions, apart from one question which asks whether or not the student is registered with the UWA Disability Office; the inclusion of this question will assist in some cross-referencing analysis between the two survey sets.

Once the results from both surveys have been collated and analysed, a series of student focus groups will be conducted during October 2006. These focus groups will target a variety of different topics from frequency of attendance at face-to-face lectures to use of portable devices when listening to recordings, depending on the survey results.

In tandem with these activities the Lectopia team will be accessing other sources of information about Lectopia use by all students at UWA, including the extraction of access statistics and logs from the system.

Study outcomes

This study is a work-in-progress, and comprehensive results (including data obtained from the campus-wide survey and focus groups) will not be available before the end of 2006. However, the results from the targeted survey for students with disabilities and medical conditions are available and can be reported here in isolation from the other study activities. Some salient points extracted from the survey results can be summarised as follows (note that the survey attracted a 21% response rate):

- 65% students deemed Lectopia to be an 'essential' learning resource, whilst 32% stated it was 'useful'
- special software is rarely used to access recordings (Dragon 3%, Jaws 1% and Zoom Text 1%)
- download is the most popular format (50%), with streaming at 25% and 25% not having a preference
- the majority of students either 'always attend' live lectures (43%) or 'regularly attend' (45%)
- frequency of Lectopia use identified as 'always' (16%), 'regularly' (40%) and 'occasionally' (33%)
- students tend to access recordings 'once' only (57%), with 31% accessing recordings '2–4 times'
- most common use of system is for 'revision and review of missed concepts' (73%), with 'unable to take notes in live lectures' at 36% and 'unable to attend live lectures due to disability' at 22%
- a high proportion of students with learning disabilities (58%) use Lectopia because they are 'unable to take notes during live lectures', compared to 27% of those with non-learning disabilities
- 38% of students with medical or mobility disabilities use Lectopia because they are 'unable to attend live lectures due to their disability', compared to 11% of those with no-medical/mobility disabilities

The survey results strongly indicate that Lectopia is meeting the needs of students with disabilities and medical conditions at UWA, and the benefits derived by these students from the system appear to greatly outweigh any problems relating to access or usability. In their written comments, over 60% of students indicated that they felt the system should either be compulsory for all lectures across campus or at least be more widespread, and expressed frustration with lecturers who were unwilling to record their lectures. Many noted that the system has been vital in enabling their learning. The increase in the use of screen capture (video of the presenter's screen) was particularly welcomed, as well as the ability to download recordings and subscribe to recording podcasts.

These results will be evaluated alongside the campus-wide survey results and the focus groups, and drawn into the system development plans by the Lectopia project team, helping to ensure that student need and demand continues to drive the system's development. Final study results will also be supplied to the UWA Diversity Projects Office and may provide important input into revising or creating University-wide policies and procedures to further support the learning activities of UWA students with disabilities.

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Throwing a pebble into the pond: E-portfolios and student engagement

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This paper reports on initial findings and implications of the use of e-portfolios for students' planning, reflecting and recording elements of their learning; issues surrounding student engagement are also discussed. A pilot study of the *PebblePad* e-portfolio software was conducted with a cross section of students: eight first year and six final year dissertation students. First year students were using the e-portfolio for their Personal Development Planning. Interviews were conducted with first year students mid semester and also at the end of their first year. Interviews were also conducted with final year students upon submission of their dissertations. Results revealed a higher level of engagement from final year than from first year students. Overall, final year students appreciated the usefulness of *PebblePad* and engaged well with the e-portfolio in the early stages of the dissertation process; however, engagement after the initial stages of the dissertation declined with students reverting to regular e-mail for contact in addition to their regular face-to-face meetings.

Keywords: e-portfolios, personal development planning, student engagement, dissertation support

Introduction

The requirement for all UK higher education institutions to implement Personal Development Planning (PDP) has generated a great deal of interest in the development of e-portfolios. These developments have created a large interest, but not necessarily a consensus, with the nature and scope of strategies for implementation left to individual institutions. The University of Gloucestershire was therefore not alone in considering the use of an e-portfolio for its PDP support but its choice of e-portfolio was also driven and informed by wider objectives to provide a means of encouraging reflective practice both in students and staff in the University. This paper reports on the initial findings and implications of the use of an e-portfolio for students' planning, reflecting and recording elements of their learning; issues surrounding student engagement are also discussed.

Choice of *PebblePad*

The two main criteria that were used in determining the choice of e-portfolio system to be used at the University of Gloucestershire, were that: 1) there should be a clear mechanism which prompted the user to add a reflection on any item submitted to the portfolio; 2) it should be appropriate for use by undergraduate students, postgraduate research students and staff. It was felt that the *PebblePad* system offered the flexibility required by a range of users, and that it had an explicit link to the recording of reflections for any material added to the portfolio.

Pilot study

The pilot study on the use of *PebblePad* was focused on the Department of Natural and Social Sciences, specifically Psychology. Eight first year students and six final year students took part in the pilot study; six second year students acted as interviewers for the first year sample.

Procedure

During the first week of semester 1, training sessions were conducted which involved a small discussion about the software and the links between the usefulness of the software and the curriculum. Instruction involved student engagement with the package and interaction between themselves and their peers, the instructor and their personal tutor/dissertation supervisor. By the end of the sessions, all students were able to create records of achievements, set up contacts, share information with contacts, and record both personal and shared reflections.

After the initial training session, students were asked to engage with the software. Specifically, first year students were asked to record and submit their PDP portfolio via *PebblePad*. As this module was not taught and assessed until semester 2, the students were asked to engage with *PebblePad* to submit their work for a module involving monitoring and assessing their progress during semester 1. This module was related to the PDP module and also included information relevant to the semester 2 PDP module. In addition, the module was assessed with a portfolio of work built over the semester.

First year students were interviewed by second year students (to ensure that students felt comfortable in giving honest responses) to assess how students were settling into the University, any problems they might be having, their perceptions of the approachability of their personal tutor, to confirm that students had engaged with the *PebblePad* software training and that they were still registered on a programme at the University; this process was repeated at the end of the academic year. First year students' engagement with *PebblePad* was thus monitored during both semester 1 and semester 2.

Final year students' engagement began immediately by planning a dissertation timetable and also planning dissertation meetings. These documents became the basis for initial discussions and reflections on the dissertation process. The engagement of third year students with *PebblePad* was monitored across both semesters. In addition, third year students were interviewed upon submission of their dissertations. As there is a more equivalent, honest and open professional relationship between dissertation supervisors and their supervisees, the dissertation supervisor conducted the exit interviews for the final year students.

Results: Student engagement

Level I

Semester 1 & 2 engagement with PebblePad
Three students actively engaged with *PebblePad* during semester 1. Of these students, most were asking for advice on planning assessments and asking for feedback. At the end of semester 1, however, only two students submitted their portfolio via *PebblePad*. During semester 2 students failed to engage with *PebblePad* and students did not submit their PDP portfolio electronically.

Semester 2 interviews
Interviews with first year students at the end of semester 2 revealed a number of issues. First, three students (one that had submitted work via *PebblePad* at the end of Semester 1) had transferred programmes during the semester and thus were no longer engaged with the programme. One of the students had access difficulties with *PebblePad* from student accommodation. Overall, the remaining students were negative about the usefulness of *PebblePad* saying that they were very familiar with e-mail and Microsoft Word programmes and felt that these were flexible enough for their requirements. Students felt that they may be disadvantaged by submitting work via *PebblePad* and simply engaged with the normal submission process for assignments.

Dissertation students

Engagement with PebblePad
All six dissertation students attended the *PebblePad* training session and used *PebblePad* to plan their dissertation timetables. All students shared these timetables with their supervisor and this was followed by two-way reflections on the timetables; a final, personalized timetable was agreed between individual students and their supervisor and supervisory meetings were planned. Students engaged well, and all planned initial meetings and advised their supervisor of an agenda prior to the meeting. After the meetings, students reflected on the discussion and checked the accuracy of comments and sought confirmation about any details that were either unclear to them or had been forgotten.

This planning and reflecting on meeting continued well while studies were being planned. Students linked work, made logs of issues and seemed very much at ease and comfortable using the e-portfolio. At least two students made explicit positive comments at this point about the usefulness of *PebblePad*. It was, however, observed that when the planning phase of the work was over, students appeared to revert to general e-mail. In fact for the rest of the dissertation process, students failed to utilize the opportunity to plan and to reflect on meetings or to engage with any other aspects of *PebblePad*.

Semester 2 exit interviews
The exit interviews with final year students revealed some interesting points. All students agreed that they had used with *PebblePad* for planning and reflecting upon early dissertation meetings. Students commented that they found the e-portfolio useful to focus discussions. Students did, however, feel that e-mail gave them more direct links to their supervisor. Students also felt that wider use of *PebblePad* may encourage usage but as many other links were maintained via e-mail then they eventually resorted to the programme with which they were most familiar. Despite their lack of engagement with *PebblePad* at the end of the dissertation process, students felt that the system allowed them to set objectives and formulate plans.

Discussion

Results revealed a higher level of engagement from final year than from first year students. Overall, final year students appreciated the usefulness of PebblePad and engaged well in the early stages of the dissertation process. All students used the e-portfolio to plan a dissertation timetable, to reflect on meetings, and found it useful as a record of these processes. However, engagement after the initial stages of the dissertation declined with students reverting to regular e-mail for contact in addition to their regular face-to-face meetings.

Interviews with both first year and final year students allowed a deeper insight into why there were problems with engagement. Pearson & Hayward (2004), in a study of General Practitioner registrars use of e-portfolios, found that engagement with e-portfolios was vulnerable to external pressures including lack of time; this appeared to be an issue for both first year and final year students. For first year students, the mere transition to university is a stressful time (Willis, Stroebe & Hewstone, 2003) before consideration of the academic demands required of students. We also know that when students are under pressure they have depleted cognitive resources. These points also appear to be relevant for final year students who appeared to engage well with the programme until around week 7 of semester 1 which was the time when data collection began and assignments for other modules were due. When cognitive resources are depleted, there is a tendency to revert to automatic rather than controlled processes (Logan, 1980). In relation to *PebblePad*, it appears that students did this by reverting to e-mail and regular assignment submission, freeing valuable cognitive and physical resources to meet the demands of situations they found themselves in.

Pearson & Hayward (2004) also found that careful introduction and support from trainers was essential to ensure usage. For our first year students, initial induction to *PebblePad* may have been better conducted in semester 2 and then incorporated into the PDP module weekly sessions. Moving training closer to the relevant learning and assignment point in this way may have facilitated more engagement. This strengthening of the link between training and learning and assessment may also have facilitated deep, rather than surface, learning and routinized its use allowing more ease of usage (Ramsden, 1992). The use of learning portfolios also requires that the training and justification for use is clearly articulated and emphasises this as a process rather than a specific assessment point. This requires challenging students to overcome strategic, assessment-focused, approaches to learning. O'Keefe & Zehnder (2004) observe that the use of media should be 'institutionalized to the point that they are taken for granted' (p.731). Initial engagement for final year students was not so much of a problem but continued usage was. Although the exit interviews for final year students pointed to them utilizing contact through the most convenient medium, again more support may have alleviated issues of non-engagement.

E-portfolios can help students become critical thinkers (Lorenzo & Ittelson, 2005) as there is substantial scope for a two-way process between students and tutors/lecturers to reflect upon learning, assessments and feedback. Indeed, one of the academic transitions to university involves raising levels of critical thinking. In addition, reflecting learning can also enhance critical thinking skills and has been an important aspect of learning in both medicine (Cook, 2004) and teacher training (Lorenzo & Ittelson, 2005). For students at all levels there are advantages for incorporating e-portfolios into the academic curriculum.

None of our sample submitted a PDP portfolio via *PebblePad* but all students did submit these portfolios in paper formats. Many of these documents were missing items that had been misplaced or were damaged by having been stored inappropriately. Electronic storage of these items would have made collecting the necessary elements easier and would have made subsequent electronic submission a very simple task.

Conclusion

This pilot study has indicated that embedding the use of e-portfolios into the curriculum is important to its successful use. Lorenzo & Ittelson (2005) suggest that e-portfolios are excellent facilities for documenting skill sets and thus ideal tools for PDP recording. Training should therefore focus more heavily on the specific aspects of both the process and making closer links to the assessment. For example, the initial experiences of our dissertation students illustrated how successful use could be as part of a clear developmental process. Our experiences therefore indicate that where students view the use of e-portfolios as part of an ongoing process, rather than leading to a fixed assessment point, this will result in a 'routinized process' and so embedded use.

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Facilitating uptake of online role play: Reusability, learning objects and learning designs

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This study tracks the uptake of online role play in Australia from 1990 to 2006 and the affordances to its uptake. It examines reusability, as one affordance, from the perspective of two often polarized constructs: Learning Object and Learning Design. The study treats "reuse" on two levels: reuse of an existing online role play and reuse of an online role play as the model for another role play. In keeping with terminology that has come into recent use, we propose that the first level implies the online role play is used as a Learning Object and the second level implies the online role play is used as a Learning Design. Thirty six role plays were identified in Australian universities, of which 80% were reuse of a Learning Design. Only three examples of role play as Learning Object were found, indicating that so far Learning Design is the more useful concept in understanding reusability in universities. Other affordances to uptake of role play were also tracked. The contribution of Educational Developers far outweighed that of colleagues, conferences, journals and engines. The results have implications for the work practices of Educational Developers and for managers of Learning Object Repositories.

Keywords: reusability, learning objects, learning designs, online role play

Introduction

It is not yet clear whether Learning Designs is a movement that will take off with the same momentum as the Learning Objects industry. This study compares the two by focusing on online role play as the example of courseware. Role play is deliberately chosen because it is a learning design that does not have its pedagogical basis in a content transmission model of teaching. Because it presents a constructivist learning environment, it may better challenge the current definition of Learning Objects. It is also an area of teaching activity in Australian universities that is small enough that it can be investigated in detail via interview and case study rather than broad-brush survey methods. Most papers on Learning Objects are very theoretical and divorced from a real context. By discussing Learning Objects and reusability in a concrete teaching and learning context, it is anticipated that recommendations will be more meaningful.

Tracking use of online role play in Australian universities

The growth of online teaching has been very rapid in the past ten years, yet implementation of role play in an online setting is growing more slowly. In a previous national study (2001–2003), the essence of effective online role play was distilled into a Learning Design from analysis of seven exemplar case studies and interviews with fifteen role play designers (Wills & Ip, 2003; Hedberg et al, 2002). Since that study the authors have tracked the growth of new designers and found additional designers who were missed in the first study because they had not published about their work or were not available for participation in the project at the time. The current study identified role play designers in Australian universities via literature review, search of university teaching and learning websites, follow-up email survey with the original designers, new interviews with some of those designers, and personal approach (Table 1).

Some role plays have stopped running after three to four times of use, either because the designer moved universities and has not yet restarted the role play in a new context, or because the curriculum has changed and the role play has not yet been re-purposed for the new learning objectives. In the first interval there was a quadruple increase. In the second interval, as the internet began to gain credence in teaching, there was a three fold increase. There is only a small increase in the last interval but this covers two years so far rather than five years. A number of new role plays are developing in at least nine universities. Some designers quoted in (Alexander, 2005, p.105) worry that online role play would lose its impact if it lost its uniqueness. Online role play is far from being at saturation point yet, but it is growing.

Table 1: Growth of online role play in Australian Universities 1990–2006

Growth in…	**1990–4**	**1995–9**	**2000–4**	**2005–6**
Number of **role plays** developed	2	7	22	36*
Number of **role play designers**	2	11	35	48

Note. * 10 of these 36 role plays are not currently running but most anticipate running again in the future

Reusability, Learning Objects and Learning Designs

Because online learning has become a large investment for universities and is now a concern of Information Technology Services and Finance Directors as well as Educational Development Centres, “reusability” has become a topic of high interest. The term “reuse” is used loosely and often overlaps with other terms like “uptake”, “adoption”, “adaptation”, “modification” and “dissemination”. In tracking the uptake of online role play in Australia from 1990 to 2006, this current study treats “reuse” on two levels: reuse of an existing online role play and reuse of an online role play as the model for another role play. In keeping with terminology that has come into recent use, we propose that the first level implies the online role play is used as a Learning Object and the second level implies the online role play is used as a Learning Design. Laurillard takes a similar approach to terminology in an unpublished presentation titled “A pedagogic focus for R&D: Generic e-learning activities as learning objects?” at an AUTC Learning Designs conference in Sydney, 2002, and in Chapter 7 of *Reusing Online Resources* (Littlejohn, 2003).

Of the 36 role plays developed during the 15 year period, 29 role plays (80%) were a reuse of another role play. Table 2 analyses the 29 role plays using the framework of learning objects and learning designs.

Table 2: Reuse of Learning Object and reuse of Learning Design

Reuse by…	Different teacher **same** discipline	Different teacher **different** discipline
same role play: Learning Object	6	0
same role play **design**: Learning Design	5	18

Before the analysis it had been predicted that most role plays would fall into the category of “Reuse of same role play design by different teacher in same discipline” as this is the lesser “distance” to transfer. However results show substantial uptake of the Learning Design by different teachers in different disciplines. That 23 of the 36 role plays are reuse of a Learning Design supports the value of the original Learning Designs project: in a university context, Learning Design is currently a more useful concept than Learning Object.

Our motivation for tracking and analysing the role plays was to chart whether a role play can become a Learning Object in the same manner as packaged print-based simulations such as *BaFa BaFa* or educational software such as *SimCity*. Only three role plays have been reused by others.

Three role plays that have become Reusable Learning Objects

The first known university-level online role play developed in Australia, Andrew Vincent’s Middle Eastern Politics at The University of Melbourne (1998), is a powerful example as it has become both a Learning Object and a Learning Design. Many of the 36 role plays now developed can track their ancestry back to Vincent’s original design. When Vincent moved to Macquarie University in another state and reused the role play there, the role play continued, and flourished, at Melbourne. At Macquarie it has been reused in schools and may be released as a part of a textbook. Therefore it counts as a Learning Object under the definition of reuse in this paper.

Elizabeth Devonshire, an Educational Developer at Macquarie (see Brierley et al 2003) and now at the University of Sydney, has reused her role play Learning Design three times. The Pain Management role play has recently been licensed to two overseas Universities and therefore counts as a Learning Object.

Likewise Maureen Bell's role play, Idontgoto University (2001), is reused by other teachers at the University of Wollongong in the same subject and by teachers at the University's Dubai campus.

Possibly, reusability in the form of Learning Objects is less likely in a University context because role play designers are highly expert in the discipline area of the role play, such as Politics or Geography, and bring a wealth of knowledge into the moderation of the role play which is difficult to duplicate in another university. Course outlines are often closely aligned to the research strengths of the academics employed in the department.

Reusable Learning Objects within online role plays

Bennett, Lockyer & Agostinho (2004), who were all involved in the original national project, have looked at Learning Designs from a different angle than the study reported here. They investigated how university teachers make use of generic learning designs as a framework for incorporating learning objects into their subjects. A Learning Design can incorporate Learning Objects, and if an online role play is built as a Learning Object then it is feasible that it could contain Learning Objects within it too. Scenarios, role descriptions, and resources produced for an online role play could all become reusable Learning Objects if developed appropriately. For example, a project at The University of Melbourne is currently investigating issues with reusing Cases, developed for Business School case-based learning, as Scenarios in role-based learning.

In this study, we found two instances where a component of a role play may be handed on as a Learning Object (Demetrious, 2003; Linser, Waniganayake & Wilks, 2004). In the first, a scenario in video format may be reused this year in a different department in the same university. In the second, a video-based scenario may be reused in a different department in another university. It is interesting that in both cases the Learning Object is in video format. Because there is a high investment in quality video production, it is worth trying to find other uses for it. In both cases the video is a very powerful trigger for the role play. However, according to one of the designers, video format can constrain reuse because the actors portray roles with real gender, age and ethnicity which cannot be modified for a different context, unlike a text-based scenario. The video scenario written for *A Different Lunch* is based in an early childhood setting. The role play issues have equal validity in a primary school setting but the video scenario precludes reuse in this new setting. These are the type of design issues that affect reuse of low granularity Learning Objects. The second part of this study will investigate the design issues for high granularity Learning Objects, that is, an entire online role play.

Other affordances to uptake of online role play

In tracking the growth of online role play, this study was looking for *reuse* as an affordance to uptake but it also noted other affordances: Colleague, Presentation/ Conference/Journal Papers, Educational Developers, Role Play Engine and the Learning Design website from the AUTC project (Table 3).

Table 3: Affordances for adoption of online role play in Australian universities

Affordance (in some cases more than one affordance)	**1990-4**	**1995-9**	**2000-4**	**2005-6**
1. Personal Handover as Learning Object	1	1	0	4
2. Colleague	1	1	1	3
3. Conference Presentation/Journal Paper		1	3	0
4. Educational Developer			10	12
5. Engine			7	5
6. AUTC Learning Design website				5

The first ten years of role play designers depended on a mix of the first three affordances. It was anticipated that after 2003 the AUTC Learning Design website would have impact, however interviews indicate that although the website has been counted five times as an affordance to five new role plays, the other affordance for these role plays is an Educational Developer. It is the Educational Developer, not the academic, who accesses the website.

Implications

Learning Objects, Repositories and Content Management Systems are presented as being the solution to reuse; however, they are really only underpinning technologies to support a university's explicit approach to facilitating reuse. Outcomes from the study reported in this paper imply that reusability must encompass Learning Objects at many levels of granularity, including Learning Objects within Learning Objects as well as encompassing Learning Designs, templates and guides plus cross-referencing in the Repository between them. A university's approach must build on existing affordances and provide reward and recognition for both *contribution* to the repository as well as for *reuse* of Learning Objects and Learning Designs retrieved from it. In addition, position descriptions for Educational Developers need to clearly articulate their role in identifying opportunities for reuse and designing for reuse. Given their indispensable role in mediating and facilitating reuse and reusability, decisions need to made about whether the Repository is designed for use by Educational Developers or for use by university teachers, as the interfaces will be different.

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Gathering online representations of practice about assessment for use as a professional development tool: A case in progress

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The Assessment Snapshots digital resource at the University of Western Sydney is a current project to produce locally contextualised resources about effective assessment practice. Assessment case studies showcased through the project offer insights into how individual teachers in the disciplines design assessment strategies which respond to the challenges of teaching and learning in the tertiary sector in the 21st century. Resources produced are designed as online professional development tools for self-access by teachers and for use in assessment workshops and curriculum renewal projects. The paper explores the rationale for using case studies as a form of representation of practice, and describes the processes taken by a team of academic developers to gather cases from individual academics, provides initial reflections on those processes, and proposes plans for using the resource and evaluating its effectiveness as a trigger for improvement in assessment practice.

Keywords: online professional development, representations of practice, case studies, assessment

Introduction

This paper describes a current professional development project called Assessment Snapshots that focuses on the development of digital resources on effective assessment practices for academic staff. We explain the processes of developing this resource, rather than the detail of the resources themselves. Using a templated interview structure, each Snapshot captures short case studies or profiles about assessment practice, using the "voice" of the teacher-developer. Our paper begins by exploring the rationale for using representations of practice (Beetham, 2001): in this context, online case studies, as a professional development tool.

Background

Helping teachers to acquire and practise "new knowledge" is a challenge faced by professional developers everywhere. An article published recently in HERDSA News (Sharpe, Beetham, Ravenscroft, 2005) focused on representations of knowledge that are potentially useful to teachers to help them change their current practices. Included as part of a wide-ranging list of types of representations were stories, narratives, profiles and case studies. For the purposes of this paper, we use these terms synonymously. These authors have also pointed out that often this knowledge has been difficult to access, and that some ways of representing this knowledge may be more effective than others. Earlier, Beetham (2001) had questioned how representations of practice help to effect change in educational practice. In research conducted in 2001, she noted that making case studies of curriculum practice easily accessible was rated highly by teachers as a professional development approach. What was not clear, however, was what Ottewill, Shephard & Fill (2002) also recognised, that we know little about how best to ensure that the potential of these resources is realised by staff accessing and using these resources in different ways.

Much of the rationale for making use of case studies is linked to the diffusion of innovation literature, and, in particular, the attributes of an innovation that Rogers (2003) believed were crucial in influencing an adopter's decision to take up an innovation. Cases can show the advantages of a new practice or approach to teaching and learning. They can emphasise the compatibility of an innovation with current values and approaches to teaching. They can be used to acknowledge the complexity or level of difficulty potentially faced by staff taking up the change to teaching practice. They can also show staff who may be reluctant to change current practice that others have made the change. Finally, providing examples through cases makes it easier for staff to see how an innovation or change in teaching practice really works (Wilson, 2006). Skilful deployment of cases in professional development activities to stimulate discussion and enable the sharing of information, advice and ideas with other colleagues can contribute over time to "learning communities" (Ottewill, Shephard & Fill, 2002).

The Assessment Snapshots project

In brief, our Snapshots project aimed to:

- diffuse knowledge and understanding of good practice in assessment at our university, highlighting the use of diverse assessment methods used across a range of disciplines, class sizes and year levels;
- promote reflection on and discussion about assessment issues within our university; and
- provide self-access learning resources for staff, which can also be used in professional development workshops related to assessment

The project grew out of our conviction that there is a wealth of excellent assessment practices within the institution which are shared amongst 'local' groups of academic staff, but which are not commonly disseminated beyond the immediate program or across disciplines. As a small team of academic developers, we decided to pilot the project and aimed at gathering a maximum of ten case studies which illustrated good practice in assessment in large classes, and to launch these on the University web site for the start of the 2006 academic year. We used our personal networks within the University to identify staff willing to contribute to this pilot phase of the project.

Developing the cases

In developing the cases, we wanted the teacher-contributors to provide their "stories" of assessment practice. Stories are "events, characters and settings arranged in a temporal sequence" (Carter, 1993). In deciding to use teachers' accounts we were guided by a previous study of teachers (Ballantyne, Bain & Packer, 1997), and the work of one of the authors of this paper (Wilson & Stacey, 2004). We were also mindful that such stories can highlight the "pedagogical reasoning" of teachers (Wilson, Shulman & Richert, 1987). We provided contributors with a Structured Interview Form (SIF) to guide them through the process of writing about their assessment practice. In developing the SIF, we drew upon a number of case study frameworks used to structure similar cases, such as the impressive DELTA (Designing Electronic Learning and Teaching Approaches) WebCT site produced by Monash University (Brack, Samarawickrema & Benson, 2004). We also found of value the KEEP Toolkit templates from the Carnegie Foundation's Knowledge Media Lab website (2006).

The SIF asked staff to describe each of the following:

- their motivation for developing the assessment activity/resource;
- their approach to resolving the issues faced in the particular assessment environment;
- the assessment activity/resource which they developed;
- their evaluation of the efficacy of the activity or resource;
- their advice for others who are interested in adapting the activity/resource; and
- the learning about their own teaching and assessment practice they gained from this experience

Each of us liaised with two or three authors concerning the writing of the case studies and communicated directly with these authors about changes required. To date, seven Snapshots have been placed on our institution's website for access by academic staff.

Reflections on the project

The first stage of our evaluation has taken the form of a number of reflections on the work completed thus far, and ideas for streamlining processes in the future. We offer these reflections in the spirit of helping others who may be considering similar approaches to professional development in their institutions.

We found it challenging to convey clearly to prospective authors exactly what was intended in terms of both content and tone for each case study. This was at least partly related to the fact that this initial group of Snapshot authors had no examples on our university website to view as a guide to what we were seeking. Subsequent authors will be relatively advantaged in this regard, by having access to a range of Snapshots written by their peers.

Many authors found it difficult to insert their personal voice into the text of their case study. Although the template asked authors to write in the first person, using a conversational tone, and the question prompts in the template are written in the active voice, most of the contributors initially wrote in a traditional academic writing style. Unfortunately this meant that the author's 'story' did not emerge clearly in the Snapshot. This challenge was resolved through discussions with the author and subsequent re-submission, or one of our team rewriting sections of the Snapshot following discussion with the author.

The storytellers responded to the SIF questions in different ways. This individuality of interpretation by contributors enhances the value of the resource, but provided a challenge for the project team - to allow individual stories to emerge while retaining a uniform overall structure of the case study. Having access to existing Snapshots will be beneficial in this regard, for subsequent contributors.

In this pilot stage of the project exploratory discussions with contributors was done individually, focusing on assisting them to think through the writing task. In extending work on this project, we anticipate engaging potential contributors in a roundtable discussion, held early in the process, supported by a set of documentation which would include illustrations of other cases to serve as examples.

Unsurprisingly, we found the length of time required for authors' writing and rewriting processes was significantly longer than planned. Three Snapshots out of the original ten in the pilot phase are still to be finalised, reflecting extensive other work demands faced by both authors and project team members.

Looking to the future, we have considered how we would expand the resource to include a wider range of disciplines and assessment practices. We have decided to issue a formal University-wide invitation to staff and to establish a more formal process of selection from a first-round submission of contributions.

Maximising the impact of the cases

Initial responses to the release of the pilot Snapshots resource have been positive. Our challenge now is to draw teachers' attention to their availability on our website, and to test their usefulness as a professional development tool for changing staff practices in assessment. Beetham (2001, p. 7) advised that "texts about learning and teaching, including case studies, articles, reviews, action research reports and evidence from video recordings or teaching observations" are powerful sources of information for staff, particularly the more experienced teachers. However, she cautioned that less experienced teachers will need support to contextualise them if they are to be seen as potentially useful. Mindful of this caveat, we are conscious that we need to plan how we best to use these resources in our work with different groups of academic staff. To date, they have been used as part of a focus on assessment in our induction workshop for new academic staff. One has been used as a resource in a workshop on designing online discussion tasks for assessment. They could also be used productively in curriculum renewal work, for example, within program-based teams of teachers that are focused on re-defining their assessment practices.

Evaluating their usefulness

In planning our evaluation of the Snapshots project we have adopted a multi-faceted approach to gathering of data about the usefulness of these cases to academic staff. These sources of data include:

- the extent of usage of the resource generated from a count of 'hits' on the web site;
- feedback emails sent to the team, and contacts by other academic staff made with contributors;
- one-to-one interviews with selected staff who indicate, by means of enquiry or feedback to contributors or the team, that they are independently making use of the resource;
- deliberately designing situations where the Snapshots can be used interactively, for example, as part of an online workshop on assessment; and

- focus group interviews involving staff who have used these resources to ascertain the extent to which usefulness has manifested in actual changes to academic practices, such as re-designed assessment, and improvements in student results. (Ottewill, Shephard & Fill, 2002).

Conclusions

Our project has aimed to produce an online case studies resource for professional development which represents current assessment practices within particular disciplines. We have emphasised our approach to collecting these stories from teachers, as well as our plans for making use of and evaluating this resource as an online professional development tool. As the number of case studies, exemplars and showcases of teachers' work proliferates on the web, it is timely that we are able to further our understanding of how these representations of practice are accessed by teachers and used by them. A future paper will draw on the results of our evaluation of this project and complete our story.

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At the limits of social constructivism: Moving beyond LMS to re-integrate scholarship

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After more than a decade, the early claims that elearning would transform university teaching are yet to be realised. As elearning, with learning management systems as the centrepiece, becomes entrenched in the mainstream, there is growing demand for a solid theoretical research base to inform elearning practice. We argue that the lack of a solid research base is in part due to the inherent difficulties with cross-disciplinary research where shared terminology does not always equate to shared meaning, and in part due to the dominant applied research approach emphasising a case-based approach over research aimed at addressing specific hypotheses derived from educational theory. We use the popular social constructivist theoretical framework to illustrate a lack of theoretical rigour in elearning research. We examine traditional university teaching as portrayed through a social constructivist lens and argue that academics already adopt the 'reflective practitioner' model in their teaching practice. We then examine the concept of adaptive self-organising learning networks in elearning. We argue that, while a social constructivist framework may be ideal for understanding the way people learn, it is at odds not only with the implicit instructional design agenda, but also with current university elearning governance and infrastructure.

Keywords: educational paradigms, learning communities, collaborative learning, organisational change, research methods and approaches

Introduction

The emerging use of computers in tertiary education dates back more than 20 years, with the First Annual Computer-Assisted Learning in Tertiary Education Conference (CALITE '83) being hosted by the University of Queensland in 1983. Online learning is a more recent phenomenon, with the birth of the World Wide Web in the early 1990s and the first Australian World Wide Web conference (AusWeb95) held in Ballina in 1995. The use of web-based delivery for computer-based learning content is now more than a decade old, and sufficiently entrenched to be the dominant model for 'elearning'.

> E-learning as we know it has been around for ten years or so. During that time, it has emerged from being a radical idea – the effectiveness of which was yet to be proven – to something that is widely regarded as mainstream. It's the core to numerous business plans and a service offered by most colleges and universities. (Downes, 2005)

Moreover, the widespread consensus at an organisational level is that central web-based Learning Management Systems (LMS) are the required infrastructure to support elearning in a quality university. According to Coates, James and Baldwin (2005)

> There is something so seductive about LMS that, despite their complexities and risks, almost every university seems compelled to have one.

LMS have been widely touted, not only as the centrepiece of elearning infrastructure, but also agents of pedagogical change (Wise and Quealy, 2006). It is presumed that LMS will transform university teaching from the outdated traditional university teaching model based around passive transfer of content to a privileged few into a broadly accessible student-centred, interactive learning model based around learning networks, interactive and collaborative technologies and communities of practice. So long as universities support LMS and elearning initiatives, it is assumed to be self-evident that innovation, change and broad-based access to higher education will follow.

As expressed by Laurillard (2005, p6)

> We could position e-learning, therefore, as the means by which universities and academics manage the difficult trick of making the learner's interaction with the academic feel like a personalised learning experience, focused on their needs and aspirations, developing their skills and knowledge to the high level universities have always aspired to, while doing this on a large scale. Elearning enables academics and students to communicate through networks of communities of practice in the cybernetic approach that makes change and innovation an inherent property of the system.

The implicit research framework of elearning

Elearning's Tower of Babel

Despite Laurillard's and others' claims that LMS, online learning and educational technology will result in a transformation of the teaching and learning paradigm, the outcomes have not quite measured up to the hype (e.g. Reeves et al., 2004; Twigg, 2001; Zemskey and Massey, 2005). Moreover, the extensive case-based literature on multimedia projects, has been partnered by only limited attempts to develop a solid scientific research base to support multimedia elearning practice underpinning this transformation (Mayer, 2005).

One of the major challenges of providing a coherent research framework for elearning derives from the inherently cross-disciplinary nature of elearning, and the resultant difficulty in discourse across discipline boundaries. This difficulty exists between any disciplines within academia but is significantly magnified when discourse crosses beyond academic disciplines themselves into areas of educational practice, professional practice, technology and management. One outcome of the difficulty in discourse is the absence of rigorous debate because proponents of different viewpoints can all too easily retreat to the insulation and comfort of their own discipline any time cross-disciplinary differences in perspective become too confronting.

Geoghegan et al. (2002) capture the role of language in perpetuating existing ideas and ways of doing things within an organisation or discipline area, and the requirement to develop shared language from outside the system to support innovation and change.

> ... an organization's language is critically important. It becomes more than simply a means for communication. It becomes a field for action, and a way of constructing truth. It becomes the basis for all transactions, the basis for all business.
>
> ... The organization's internal language is designed to help managers facilitate present-day business—not look beyond it. Using the internal language, managers increase efficiencies, but cannot recognize new fields of research, new discoveries, new approaches.
>
> Like all of us, they cannot recognize their own limitations. Constrained by the previously successful language, we do not know that we do not know. Consequently, we think we know— and thus cannot learn. Developed as a tool to increase efficiencies, the organization's language, paradoxically, becomes a trap.
>
> The conversations necessary for creating fundamental change do not come naturally. They pose questions that cannot be understood in the organization's present language. The conversations necessary for generating new opportunities come from outside the system. Their language has a different history. It is often technically and intellectually demanding. Consequently, it is often dismissed. (Geoghegan et al., 2002)

The internal language of an organisation constrains its ability to adapt, and so it is with research activities that use their own internal language. In elearning a particularly frustrating aspect of the existing literature is the seeming lack of connection between theory and practice in the dominant applied research paradigm. Much of this research claims to be "situated within a framework" but, despite using some of the language of that framework, does not actually test any specific hypothesis deriving from the theoretical perspective.

And yet it does not seem entirely unreasonable to suggest that if research is to guide the use of technology to enhance learning, it is an important prerequisite to have firmly-grounded and plausible models of learning and of teaching, and a clear articulation of the desired outcomes from our teaching practice. It is not enough to describe specific elearning projects, addressing explicit questions relating to these projects but ignoring the deeper implicit theoretical positions reflected in the project design, if this research is to drive a far-reaching agenda for change of practice within the higher education sector.

An implicit theoretical position loosely based around social constructivism (e.g. Brown, Collins and Duguid, 1989), communities of practice (e.g. Lave and Wenger, 1991) and learning networks (e.g. Siemens, 2005; 2006) has been used to underpin the transformational potential of elearning in higher education. We argue that, far from providing an appropriate theoretical framework for university elearning practice, a social constructivist perspective is at odds not only with much of the implicit instructional design agenda but is also at odds with current university elearning governance and infrastructure. Despite an elaborate rhetoric around social constructivism, communities of practice and learning networks, the direction of elearning practice in universities, and in fact the intrinsic nature of institution-based education itself, is not easy to reconcile with social constructivist principles. Universities are responsible for teaching their students and accrediting the resultant learning outcomes through awarding of degrees. The fact that much learning activity takes place outside formal teaching institutions does not speak directly to the relevance and effectiveness of institutional teaching *per se*, nor does it entail that universities must adapt their teaching practice to embrace social constructivist student-centred learning principles.

Elearning, communities of practice and the shattering of scholarship

Laurillard (2002) invokes a social constructivist theoretical position to argue for a new kind of university teaching, based around notions of community of practice, networks and creativity.

> For some time now, academics have been arguing for a radical shift from the standard transmission model of university teaching. Donald A. Schön, for example, demonstrated the need for a "reflective practicum" in universities, where students can prepare for their future careers when existing professional knowledge will not fit every case. Practitioners have to make sense of uncertain, unique, or conflicted situations of practice through "reflection-in-action," and they need to be able to go beyond the rules—devising new methods of reasoning, strategies of action, and ways of framing problems. This presupposes a very different kind of university teaching... (Laurillard, 2002)

She describes academic research communities in social constructivist terms as exemplars of processes which foster creation and development of knowledge:

> The academic research community has perfected a process that fosters the creation and development of knowledge, and that is so effective that its basic characteristics are common to all disciplines. I think it is fair to say that all academic disciplines share a fundamental set of requirements for high quality and rigorous research. The academic professional as researcher is:
>
> - fully trained through an apprenticeship program, giving them access to competence and personal engagement with the skills and scholarship in their field;
> - highly knowledgeable in some areas;
> - licensed to practice as both practitioner and mentor to others in the field;
> - building on the work of others in their field whenever they begin new work;
> - conducting practical work using the agreed-on protocols and standards of evidence in their field;
> - working in collaborative teams of respected peers;
> - seeking new insights and ways of rethinking their field; and
> - disseminating findings for peer review and use by others.

> In the context of research, academics measure up well to the idea of ‘the reflective practitioner’ (Shon, 1983) working within a ‘community of practice’ (Wenger, 1999). The progress of innovation is rapid and effective. (Laurillard, 2005, p4)

The initial impression is that Laurillard is lauding academics for creating a ‘community of practice’ apprenticeship model within their discipline. But surprisingly, although such a model (whereby the expert academic is guiding students into the community of practice of their academic discipline) is deemed appropriate for fostering research communities, Laurillard does not credit this model to be an appropriate university *teaching* model to lead to the learning outcomes required for the discipline. Laurillard assumes that there is a separate pedagogy above and beyond an academic’s expert knowledge that applies to teaching a discipline.

> Now run through the above list again and consider whether the academic professional as teacher possesses these characteristics in relation to the field of the pedagogy of their subject. None of them, typically, apply. Not even number 2, since academics are rarely specialists in the pedagogy of the subject, beyond a simple reliance on expert knowledge. (Laurillard, 2005, p5)

The ‘community of practice’, social constructivist, contextual model of learning that Laurillard overtly subscribes to surely entails that an expert academic researcher as teacher is one and the same as the reflective practitioner working within a community of practice, particularly in academic institutions emphasising a commitment to ‘research-led teaching’. Expert knowledge is precisely what an academic does rely on. Learning around communities of practice assumes that the focus of learning is around how to become a reflective practitioner within that specific discipline or practice. The community is the mechanism by which like-minded groups of practitioners define themselves as a discipline and define the nature of their expertise.

Although social constructivist learning is a fashionable and pliant framework for elearning, the challenge for educationalists is that within this framework, there is inherently limited formal control over what is being learned or how it should be learned. This, one would think leaves little room for any explicit educational design role in terms of curriculum and learning design. Individual learning is the responsibility of the learner and the nature of discipline expertise is the responsibility of the community. And if, as we would argue, the core discipline-based knowledge evolves through activity within the communities of practice rather than through the outside agency of educational design, what is left for the social constructivist educational designer to do other than sit back and watch the learning unfold? If learners construct their own understanding within their learning community rather than being taught a set curriculum, there should be little need for explicit teaching methodology.

Yet Laurillard suggests that academics must learn a specific model of expert university teaching, a position that is difficult to reconcile with a social constructivist, community of practice framework.

> All academics, therefore, need to cover the full range of professional skills of both research and teaching, They will differ in proportion, of course, but there is no easy exit from the responsibility of every university to offer its students access to expert teaching informed by current research, to give them the capabilities they need for their own professional lives. University teaching must aspire to a realignment of research and teaching and to teaching methods that support students in the generic skills of scholarship, not the mere acquisition of knowledge. Forward to the past: universities have to manage on a large scale the same values, aspirations and modus operandi they used for a privileged elite. (Laurillard, 2005, p5)

It is difficult to conceptualise ‘generic skills of scholarship’ outside the context of the act of ‘acquisition of knowledge’ It is also difficult to find a substantive argument with respect to models of university teaching initiating, let alone directing, a change in practice. Nevertheless, one is asked to accept that changes in teaching practice are required on the grounds of technology, knowledge economy, and student demand:

> If there is to be innovation and change in university teaching –as the new technology requires, as the knowledge economy requires, and as students demand – someone has to take responsibility for it. (Laurillard, 2005, p5)

In this argument and the many like it, there has been no clear link built between specific problems with university teaching and specific affordances of new technology. There has been no clear articulation of the characteristics of the 'knowledge economy' and its unmet requirements in current university teaching. There has been no examination of the nature of 'student demand'. There is only a juxtaposition of discussion regarding communities of practice in research and an unsubstantiated claim that it is somehow the *new technology* itself that requires innovation and change in university teaching. It is not at all clear how one claim leads to the other, and why new technology requires change and it would seem somewhat irresponsible, if not downright dangerous, to transform an educational institution without a well-established, soundly reasoned cause. While Laurillard frames her work in a social constructive setting, she seems reluctant to accept the consequence of this position in terms of educational design and the nature of academic teaching.

LMS, communities of practice, networks and pedagogy

As discussed in the previous section, much of the conversation around elearning and its transformational potential refers loosely to a social constructivist pedagogy, communities of practice and learning networks. And, as described in the introduction, most universities construct their elearning environment around some form of LMS. In this section, we explore how social constructivist theory fits within typical university LMS implementations.

The majority of university degrees are based around degree programs made up of individual units of study (courses, in the US-dominated LMS world) and LMS are structured around course-based delivery of content to nominated cohorts of students. LMS operate around formal structure rather than organic growth and therefore do not encourage the flexibility and autonomy inherent in communities of practice. The basic element of LMS architecture is the course and there is little genuine opportunity for unstructured between-course communication and sharing. As Downes asserts:

> Probably the greatest misapplication of online community lies in the idea that it is an adjunct to, or following from, the creation and design of an online course.... the relation ought to be the other way around: that the course content (much less its organization and structure) ought to be subservient to the discussion, that the community is the primary unit of learning, and that the instruction and the learning resources are secondary, arising out of, and only because of, the community. (Downes, 2004)

Of course it is possible to build a community of practice within an LMS, just as it is possible to ride a bicycle on a freeway, but standard LMS architecture and roles do not encourage it. Even Moodle (http://moodle.org), specifically built around a social constructivist philosophy, does not easily support organic growth of communities of practice except within a course-related metaphor – that is to say, a community of practice 'course' needs to be created and people join it rather than natural aggregations of like-minded people evolving into a community of practice through the nature of their interactivity. This is not a criticism of Moodle, since it was designed to support online delivery of courses. It is a criticism of the way in which social constructivist pedagogies and online learning have been conceptually conjoined with little attention to theoretical detail.

Social constructivist learning does not require technology, and does not emerge directly from use of online environments. Educational technology is agnostic with respect to pedagogy, and can support the most didactic teaching methods – in fact, the more didactic it is, the easier it is to support. The link between LMS, learning networks, and communities of practice, despite the upbeat marketing rhetoric of LMS vendors such as Blackboard (http://www.blackboard.com), is by-and-large one of 'guilt by association' in that both terms are closely associated with the term elearning. Laurillard (2005) adds to the chain of association by positing the centrality of learning networks, communities of practice, and computer networks in the supposed "new pedagogy".

> E-learning enables academics and students to communicate through networks of communities of practice in the *cybernetic approach that makes change and innovation an inherent property of the system*. At the same time, we need a way of creating the common infrastructure of agreed standards of interoperability that enable, and do not frustrate innovation. (Laurillard, 2005, emphasis added)

Dynamic, adaptive, self-organising networks have been described in the artificial intelligence and cognitive neuroscience domain (e.g. Edelman et al., 1984) and may provide appropriate models for exploring knowledge representation and governance from a cybernetic epistemological stance as will be discussed further below. The adaptive, self-organising cybernetic properties of social networks are based around the idea that humans themselves form the integrative nodes of such networks. However the *'common infrastructure of agreed standards of interoperability'* invoked by Laurillard presumably refers to computer networks and to internet protocols that allow software agents to interoperate rather than to interactions between people. The fact that social networks communicate via computer networks does not entail any formal mapping of network architecture between the social and computer domains although one, both or neither could behave as self-organising and adaptive networks in any number of possible predetermined or emergent mappings.

The juxtaposition of like terminology across domains is not a strong argument for the claim that social learning networks will inherently acquire adaptive "cybernetic" properties. It does *not* mean that substantive change and innovation will be inherent properties of any learning network. The essence of an adaptive system is that it *responds* to change and innovation, but this is not the same as initiating it. In complex systems, the source, direction and value of changes are hard to predict. In some complex adaptive systems, the nature of the overall network response to changed inputs at some or all of the nodes is sufficiently complex that it changes the nature of the system, resulting in true change and innovation. But the direction and value of such emergent transformation is hard to predict. And the idea that any change and innovation in traditional teaching practice is of itself necessary and "good" is neither self-evident nor well supported by reasoned argument. The contiguity of statements about change, elearning, adaptive networks and cybernetics has a pleasing ring of authenticity about it but requires much deeper domain-specific argumentation to provide any insight into the role of elearning in pedagogy and knowledge representation, and the effect of change on the traditional university as an organisational system.

Organisation and quality control

Coates et al. (2005) bring to light the inherent tension between different conceptualisations of the role of LMS by highlighting the opportunity afforded by LMS to regulate teaching practice.

> LMS offer universities hitherto undreamt-of capacity to control and regulate teaching. From a managerial perspective, the disorder associated with academic independence and autonomy in the teaching and learning process can appear chaotic and anarchic. The management and leadership of academic communities requires, correspondingly, a high tolerance of uncertainty, but such tolerance is increasingly in short supply in an era of attention to quality assurance and control. LMS may appear to offer a means of regulating and packaging pedagogical activities by offering templates that assure order and neatness, and facilitate the control of quality. The perceived order created by teaching and learning by LMS is, we suspect, one of the more persuasive reasons for their rapid uptake. (Coates et al., 2005)

The ability to control, regulate and audit teaching through an LMS sits uneasily with the portrayal of LMS and elearning as harbingers of innovation and change to traditional university pedagogy. On the one hand, it is claimed that elearning (delivered via a central LMS) will allow unprecedented opportunities to build enriched student-centred learning environments and communities of practice free of spatiotemporal constraints; on the other hand, it appears that LMS provide a means to create perceived order in teaching and learning practice. This brings to the foreground the intrinsic tension between creativity and innovation versus regulation and control in the domains of pedagogy and management respectively. Any serious advocate of elearning as a vehicle for pedagogical transformation will need to confront and resolve the inherent conflict between order and creativity, between the checklist-based quality of observable outputs ("content") and the qualitative evaluation of teaching and learning quality, and between autonomy and independence on the one hand and regulation and control on the other.

Laurillard acknowledges the dichotomy in her use of the deterministic versus cybernetic metaphors in her consideration of governance structures which might support innovation in higher education:

> ... if we try to innovate through command and control methods, the innovative idea weakens as it travels down the hierarchy and confronts the local knowledge system ... in an adaptive, or cybernetic structure, the model is not a unidirectional graph, but a network, with multiple two-way links between all nodes, even if there is a hierarchical organisational structure. These localised dialogues allow localised versions of the innovation to spread downwards, customised versions to spread sideways to peer groups, and generalised versions to travel upwards to managers and leaders... (Laurillard, 2005, p3)

There is much to recommend in an approach favouring multiple adaptive linking between nodes of the governance network, but Laurillard's use of the terms adaptive and cybernetic is a re-description of the desired outcome rather than a meaningful discussion of the method by which it can be achieved. Innovation does not spread merely by virtue of being injected into a network. Self-organising adaptive networks are generally implemented as a system of interconnected nodes with predefined weights which can be (but do not have to be) modified by the pattern of input across the network. The syntax of the network (how information is put together) is a non-trivial aspect of semantics, but once the syntax is in place, semantics in a given network is primarily a function of input to that syntactic structure. The ability of a network or organisation to reconfigure its weighting of inputs adaptively (change the nature of interaction between input at fixed network nodes) is possibly more about efficiency or subtle nuance rather than a true capability to initiate innovation or respond to change since by definition the syntax of the network specifies the constraints underlying the meaningful combination of inputs. The critical issue of how reciprocal interactions between different hierarchical levels of governance could be structured to support the injection of "good" change while ensuring protection from "bad" has not been addressed by Laurillard.

Self-organising adaptive network models sit uneasily within the governance framework for LMS, because LMS are inherently structured around a command-and-control governance mentality and are not dynamically adaptable. It is difficult to see how course-based LMS could support self-organising communities of practice and learning networks and their associated highly adaptive and flexible governance structures. The social constructivist pedagogical mantra of many online learning experts is hard to reconcile with the implicit "command and control" mentality underpinning educational design and LMS.

The apparent lack of awareness of this glaring theoretical inconsistency is worrying and has implications for the capacity of universities to embrace Elearning 2.0 (Downes, 2005), whose underlying conceptual framework is fundamentally different from that of traditional LMS and project-based multimedia forms of elearning. The dominant grammar of Elearning 2.0 is based around active verbs rather than the passive nouns of the traditional web. The shift from a passive consumer perspective to that of an active participant is hidden in linguistic nuance. Key words like 'interactive', 'transformational', 'hyperlink', 'engagement', 'student-centred', 'discovery-based' have been used frequently in traditional discourse about elearning, but in Elearning 2.0, the interactions relate to online communities of practice across the whole web rather than to cohort-based controlled learning experiences. More importantly, interactions are inherently bi-directional and the implicit concept of centralised control is completely relinquished. Educational designers who have urged student-centred learning in which students take responsibility for constructing their own knowledge will now be faced with an embarrassing largesse of accessible content, freely available tools to interact with it, and freely available tools to create more of it.

Back to the future: Transparent ivory towers

Elearning 2.0 is the emerging theme in discussions on the future of elearning environments. Elearning 2.0 is based around open access, interactivity, creativity and sharing using freely available online tools. Elearning 2.0 is inherently not institutionally-governed in the sense of controlled delivery of approved content and communication channels to enrolled cohorts of students. With the move away from approved content and approved communication channels, Elearning 2.0 is also not focussed around educational design. Educational designers are increasingly faced with the possibility that their mediation in the process of building elearning constructs is no longer required.

Perhaps it is time to revisit the pedagogical arguments for the need to transform outdated university teaching and learning practice to embrace the new technologies of the 21st century. There is no compelling support for the claim that LMS and elearning will transform university teaching. Moreover, the social constructivist, community of practice framework adopted by many in the elearning community does not appear to be well matched to the underlying principles of educational design nor to the concept of institutional university-based teaching. As Scott Leslie observes,

> [we must acknowledge] the key role in institutional learning of 'credentialing' - not to reduce it to that, but to acknowledge that in the nirvana of self-forming online learning communities and self-directed learners someone is going to have to start talking about the relationship between that learning and the powerful role of credentialling (and to be fair, this isn't just the institutions of higher ed involved in this, it's governments, accrediting bodies, professional organizations, etc.). (Leslie, 2006)

The emerging Elearning 2.0 model has the potential to provide unpredecented opportunities to enable online learning networks and communities of practice, but it is able to do so without reference to university elearning infrastructure. A major challenge for universities around elearning will be to understand the diminishing value of specific content. Another significant challenge is to understand that, while a large proportion of learning takes place outside traditional instructional settings aligned with the principles of social constructivism, this is not a new phenomenon and is only loosely related to technology. University education has traditionally been about teaching the theory and practice of specific academic disciplines rather than providing vocational trained, job-ready students to industry, and an important aspect of the teaching role of the university is to provide accreditation that students have mastered the knowledge within their discipline of study.

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Understanding complex calculations: Automated spreadsheets with built-in feedback

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The e-Learning team at the University of Sydney was approached to help develop a resource that would address some areas of learning difficulty that had been identified in two engineering units of study. Complex spreadsheets were developed, then automated with VBA code to provide the students with a formative assessment resource, based on scaffolded learning with immediate feedback. Twenty spreadsheets were eventually made available to second- and third-year students. Student evaluations have led to further development of the feedback features to make it clearer to students why some answers were correct or incorrect, and thus to improve their conceptual understanding of the principles behind the mathematical calculations.

Keywords: teaching and learning strategies, instructional design, personalised learning

Introduction

Engineering students need practice in applying the principles they learn in class to real life situations. They also need to be able to understand what happens when the parameters of a problem change. There was concern that students in the core subject of Fluid Mechanics were under-achieving, and six specific areas of student difficulty were identified:

- appreciation of dimensions;
- problem visualisation;
- understanding the sensitivity of output to changes of input;
- confidence in conducting routine calculations;
- logical layout;
- generic computing skills.

The USyd e-Learning team undertakes a number of strategic projects each semester, assisting and supporting academic staff to improve learning outcomes and teaching satisfaction. They were approached to assist with the development of a resource to improve the students' chances of meeting the desired outcomes of this unit of study. The aim of the project was to create a self-learning resource that would first remind the students of the basic underpinning paradigms of the problem that they had learned about in lectures and tutorials, then develop their understanding of these paradigms by allowing them to practise problems over and over with different input and parameters.

The desired outcome was that students would acquire the key concepts of Fluid Mechanics, and the strategy adopted was both teacher-learner focused and student-focused. The aim was that the students' own understandings of the concepts presented in class would be developed and deepened, following Trigwell and Prosser's (1997) Approach C and Approach D. Each of the 20 problems developed used a carefully structured approach to develop and deepen the student's understanding of and confidence with the use of the concepts.

Theory and method of development

As the generic computing skills that students need to develop include advanced use of Excel spreadsheets, a model was developed based on the work of Paul Blayney and Mark Freeman, who had created similar workbooks, with some formative feedback, for their students' summative assessment (Blayney & Freeman, 2004). However, their workbooks had different educational goals in reinforcing simple calculations and were used for summative as well as formative assessment, requiring a much higher level of security.

The spreadsheets

A set of ten staged problems was developed in Excel workbooks for each of the two units of study (studied in years two and three of the four-year degree). These were created so that the problem seen by the student each time they opened the workbook was generated on a hidden worksheet from a set of pre-determined variables. This hidden worksheet was also used to record the correct answers. VBA code was then added so the students could both work on the problems repeatedly with different pre-determined parameters, and get immediate feedback for their answers, which the code checked against the correct ones on the hidden sheet.

Each workbook presents a reasonably complex problem in which the real-life parameters could vary widely. This might take the form of either an important theoretical concept or a real-life situation in fluid mechanics, and is usually accompanied by a diagram and/or a key equation. Examples of both a theoretical concept and a real-life problem are shown in Figures 1 and 2. The underlined text indicates variables that change every time the student attempts the problem.

Consider Eq 1 for a particular stream function, where A = <u>3,</u> B = <u>-3,</u> and C = <u>0.05.</u> Specific streamlines will be required for calculations later.

$$\psi = A \cdot \frac{y}{(x-B)^2 + (y-C)^2}$$

Eq. 1 Streamline function

Figure 1: Example of a theoretical problem

A seafaring vessel used for transporting <u>mercury</u> has the form shown, where the dimension d is <u>5.5 m</u>, and the width of the tank, w, is <u>3.3 m</u>. The dry mass of the vessel is <u>5 tonnes</u>.

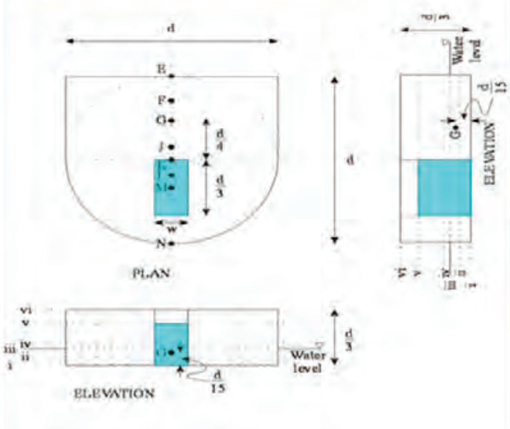

Figure 2: Example of a 'real-life' problem

Each workbook consists of two worksheets: 'Qx', which the students see, and 'Variables and Inputs' (V&I), which is hidden from the students, and which contains the variables that are selected to make up the problem. The hidden V&I sheet was prepared first, with the problem stated at the top and the variables generated with the LOOKUP function. The parameters of these variables varied, depending on the problem being addressed, but there were always 25 different sets of variables that could be randomly selected to create the question that was presented to the students, and that would determine the results of their calculations in the final stage of each problem.

The Qx worksheet, the one seen by the students, has the problem copied from the hidden V&I sheet at the top, often illustrated by a diagram or key formula as shown in Figs 1 and 2 above. The questions that relate to the problem are staged, usually in three steps, thus scaffolding the students' understanding.

It is not possible in this paper to go into detail about he development of the spreadsheets (which requires familiarity with the advanced functions of Excel such as VLOOKUP and INDEX), or how the VBA code was written, the principles of which are described in detail in Blayney and Freeman (2004). We will limit ourselves to a description of how the development process was aligned with the intentions and outcomes of the project, which were to address the six problems listed in the Introduction that had been identified with students' ability to visualise and solve engineering problems using the strategies described in Trigwell and Prosser (1997).

The structure of the problems

Each of these staged problems was carefully developed to test and build student understanding in a structured way, using the scaffolding steps outlined by Biggs' SOLO taxonomy (Biggs, 2003). Students are not able to enter any answers to Q2 until they have correctly answered all the questions in Q1, in which they demonstrate their understanding of the dimensions used in the problem. (There is no limit to the number of times they can try Q1.) They cannot then progress to the calculated questions in Q3 until they have completed Q2 correctly, giving them the opportunity to develop a conceptual understanding of the key factors they will need to consider in their calculations.

The first set of questions is usually a matching question that asks students to identify the units of measurement that would be used, or tests their knowledge of other basic information in a way that Biggs would classify as 'unistructural'(Biggs, 2003). This relates to the students' need to appreciate the importance of dimensions in calculations.

The next set of questions, usually multiple choice, requires the students to visualise the problem and identify the key components that would be needed to solve it. For example, in the boat question in Figure 2, students are asked questions about how they visualize the equilibrium of the vessel and location of the centre of gravity. These questions correspond to Biggs' (2003) 'multistructural' and 'relational' steps. They assist the students to develop their skills of problem visualisation.

When they have completed these preliminary questions, and thus oriented themselves to the dimensions and key issues of the problem, students are asked to solve a series of complex calculations, modelling the calculations that engineers need to be confident in making. This step is an example of Biggs' (2003) 'extended abstract', and it moves them from a detailed consideration of the parts of the problem to its solution *in toto*.

Some calculated questions appear more complex to the students, for example being presented in columns and requiring them to work out a formula, then drag to fill down. This is one of the ways that the lecturer built in challenges to enable the students to practise their basic computing skills, which they will require when practising as engineers. Others included more advanced use of Excel functions such as 'Goal seek' in the later spreadsheets.

Feedback

The VBA code was used in several ways to give the students feedback on their attempts, as we considered that immediate and detailed feedback would be appreciated by students as contributing to their understanding of basic concepts. However, the initial method of providing feedback proved inadequate for the students' needs.

First iteration

Direct feedback for **incorrect** answers to the conceptual questions (the second level of questions in the worksheets) was provided in the first iteration by the Microsoft message box provided by the Visual Basic command 'msgbox'. These included hints, extra information, and pointers to pages in the course texts for further assistance. However, this box proved to be limited in its application for this mathematical exercise, as it wasn't possible to express exponents, Greek letters or other basic mathematical symbols. Also, the box that provided the feedback disappeared as soon as the "OK' button was pressed, so there was nothing left on the screen for the students to consider. Figure 3 shows text from two of the feedback message boxes.

Figure 3: Text of two message boxes

At this point it was considered unnecessary to create feedback for **correct** questions, partly for time constraints on the project. However there were other kinds of feedback used in this first iteration. For some of the calculation questions equations became visible to students as a clue after they had attempted the problem themselves, and sometimes extension activities were revealed after the correct answers were completed. These took various forms, such as further diagrams or equations, or tables in which the students could change variables and see the result of these changes on output demonstrated in dynamic graphs in Excel.

Changes in the second iteration

At the end of each semester the students evaluated the worksheets were evaluated by a voluntary questionnaire (Scott & Ward, 2006). This revealed that the students had found the multiple choice (conceptual) section of the worksheets to be of limited usefulness, because they sometimes didn't know why their lucky guess was correct, or their unlucky guess wrong. This meant that they had to keep changing their answers and clicking the 'assess question' button until they hit the jackpot, and, has already been explained, it also meant that they couldn't move on until they had found that lucky combination. It also meant they had no idea why their answer was correct nor the desire to read the notes to find out for themselves.

So in the second iteration textboxes were added, coded blue for correct or red for incorrect, that are hidden when the worksheet is opened, but that appear after the student has pressed the 'Assess Question' button in direct relation to the answers provided. These provide detailed feedback on each answer in the second section of questions – the section that tests and builds conceptual understanding. Now the students have the chance to develop a good understanding of the concepts that underlie the problems before they apply their understanding by attempting the calculations that make up the third part of the problem rather than just trying out answers until they get them all correct. If their answer is wrong they can read the feedback that is staged according to how many attempts they have made, and make a more educated attempt at the multiple choice the second time. This feature is currently being trialled with a new cohort of students, and has yet to be evaluated.

Conclusion

The target audience for these problems was initially students who were keen enough to make some effort and realise that practice might be beneficial; it was staged formative assessment for students to work on in their own time and at their own pace. We were realistic enough to appreciate that many students will only do the minimum necessary to pass the unit of study, with some motivated enough to do some extra work. However, the completion of two of these problems has become mandatory for all students enrolled in the units of study, as many of the students admitted in the evaluation that they had not used the sheets as they 'were too lazy' and 'didn't have time'. It will be interesting to see in the future if the evaluations change over time if students are mandated to attempt at least some of these worksheets.

These worksheets are initially time-consuming to develop but not especially difficult to set up, and the first workbook developed forms a template. They may lack something in presentation (the Microsoft message box is a particularly unattractive object, not easily customised), but they provide a practical framework for students to extend in a carefully scaffolded way the work presented in lectures and reinforced in tutorials, especially the more complex concepts, and get immediate detailed feedback for their efforts.

Only one cohort of students has completed both the second- and third-year units of study, but there is some evidence indicating a slight correlation between an individual's availing themselves of the opportunity to complete some of these worksheets and a trend from fail to pass in examination results (Scott, Ward, & Wood, 2006). Qualitative and anecdotal feedback also indicates that some students appreciate the learning opportunity this resource has provided. The problems provide a model of a logical layout, and give students the opportunity to learn generic computing skills that they will use when they begin their professional lives. Students can see how to model a conceptual problem mathematically, they learn the importance of dimensions, and they can gain confidence in doing calculations that will become routine to them. They can also repeat the problems as many times as they choose with different variables, and see how the changes in input affect output.

Student responses recorded in the initial evaluation of the spreadsheets and in their informal discussions with the lecturer have led to the development of the textbox feedback, and a new cohort of students, who will be mandated to attempt these problems, will be re-evaluated for their reaction to the textbox feedback over several semesters in order to continue to improve the spreadsheets and make better use of them as a teaching tool.

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Designing reusable online clinical reasoning templates: A preliminary evaluation

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As increasing resources are devoted to the production of online learning materials it is important that both the usability of such resources by educators and the educational usefulness of these resources for student learning are evaluated. Outcomes from such evaluations provide information that can be used to inform future development of online learning materials. This paper describes two clinical reasoning templates that were developed to enable easy incorporation of content materials by educators without specialist web design skills, and easy access to the materials by students with minimal software requirements. Preliminary evaluation data will be presented describing the usability of the templates by educators and students.

Keywords: online learning, health science education

Background

Whilst evaluation of learning in higher education is a well researched area, evaluation of online learning materials is only just emerging (Richardson, 2005; Hess et al, 2005). Effective implementation of online learning materials requires careful evaluation of both the student experience with the online learning materials and the usability of the templates by educators with little or no online educational design skills (Sheard & Markham, 2005). A common problem with the development of online learning materials is that their use is not sustainable over time requiring complex technical skills before the materials can be disseminated to different learning contexts. In addition there are frequently problems related to access and usability of the materials by students.

During 2005 two online clinical reasoning templates were developed as part of a USyd eLearning project (University of Sydney, 2005). The aim of the materials was to allow students to work though clinical information on their own, and model the clinical reasoning process undertaken by practicing clinicians to determine the patient's clinical problem. The templates needed to provide opportunities for students to follow their clinical reasoning processes and also where indicated, receive pre-designed feedback. The templates also needed to have components that can adapt to different disciplines, be easy to use, and create an interesting learning experience for students.

The templates

A team consisting of two educators in the School of Physiotherapy, two educational designers and a project manager developed two templates that enable students to work through the patient assessment (history taking and physical examination) and develop a clinical diagnosis and treatment plan. The project was limited by the lack of availability of a data base storage system that would allow individual student responses to be stored as they work through the clinical case. Initially the templates were developed for the discipline of physiotherapy; however as described below in “the educator’s view” section below, are able to be adapted for any context. The project required 650 hours of educational designer and project manager’s time which included planning with a review of the available technology, development with formative evaluation of project processes, construction of a website with guidelines for modifying the template content, and two sessions to introduce the templates to other interested academics as part of the implementation phase of the project.

The student view

Students require the program Adobe Flash Player 8, which is commonly used by web providers, to work through the two types of cases. If the computer does not have the necessary software the template is able to detect this and direct the user to download the free software. In this study the cases were delivered in the Unit of Study’s website through the learning management system (LMS) WebCT. The case instructs students to move through each of the sections at their own pace and work independently of any lecturer input. Depending on the template used the student is required to input their reasoning processes with justifications.

The first model “Clinical Reasoning” asks students to engage in a deductive clinical reasoning process by recording and refining their thought processes as clinical information is progressively revealed. The design was influenced by the hypothetico-deductive approach to clinical reasoning which is commonly used by novice practitioners (Higgs & Jones, 2000). At the completion of the case the students are able to compare their reasoning with that of the academic who developed the case. The Clinical Reasoning model has five sections (Figure 1):

- Instructions for the students
- History section, where after each presentation of information the student is required to enter their hypothesis and reasons based on the information they received. As further information is revealed they are able to modify their hypotheses with the aim of reducing the number of hypotheses as more information is given
- A physical examination section whereby a similar process continues
- A solution section where the student is able to compare their final hypothesis and reasoning about the patient’s clinical problem with the lecturer’s answer
- A treatment section where the student develops a treatment plan

The second “Efficiency” model encourages students to be selective in their choice of clinical tests to arrive at the correct diagnosis in an efficient manner. It encourages more of a ‘pattern recognition’ approach to clinical reasoning which is characterised by speed and efficiency (Higgs & Jones, 2000). After being supplied with the patient’s history, students are asked to select the most important examination results, hence recognizing clinical pattern of a condition, before making a diagnosis. The Efficiency model consists of four sections which were applied to the discipline of ophthalmology as follows:

- Instructions for the students
- History section for patient history information and images or movies
- Ocular examination: Results of clinical tests with images and movies where necessary
- Diagnosis where the student chooses a diagnosis and enters justifications for their choice which can be emailed to the lecturer.

The educator’s view

The templates were designed using an Adobe Flash file reading content materials from xml documents, and images and videos from a set directory structure. This allows educators to develop new case studies by inserting their own materials using a simple text editing program such as Notepad or WordPad. The headings can be modified to suit the terminology in various disciplines, and images and movies can be added to enhance the case. The templates are made available to educators through the University’s learning management system (WebCT). This includes fully completed examples, a zipped file with all the

components necessary to create a case (folders and files) and instructions to assist educators to adapt the materials. Educators are able to modify the content of each component of the .xml files (including headings) and review their changes immediately on their local computer.
The main limitation of the templates is that the relationship between each of the sections of the template (xml files and swf file) is not able to be altered without an experienced Adobe Flash developer.

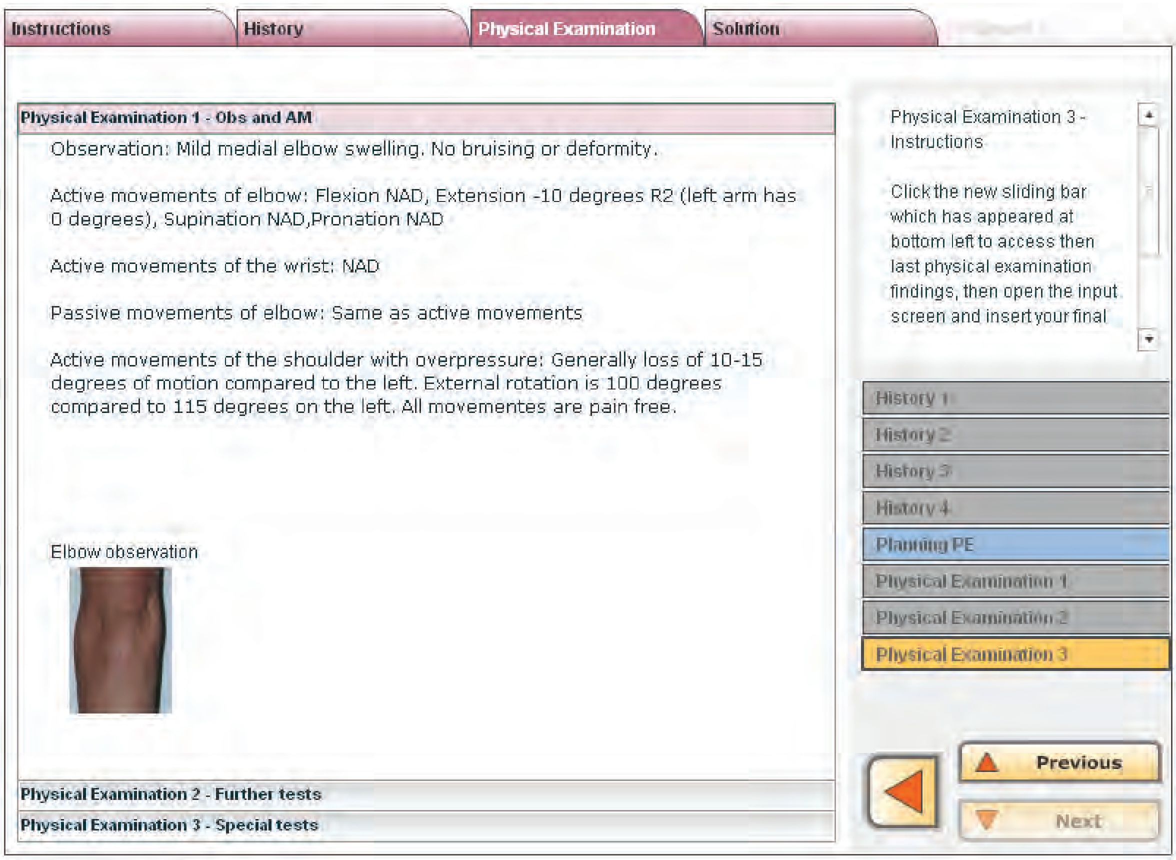

Figure 1: Clinical reasoning model

Preliminary evaluation research

A learning-centred framework (Phillips et al, 2000) was used to select the focus of this evaluation. Since the project aimed to develop accessible and useable templates, summative evaluation data is required to assist in making a judgment about the implementation of the templates and the ability of the templates to transfer to other areas of the institution (maintenance evaluation). The research to be presented aims to begin this process and is specifically seeking to determine information about:

- The usability of the templates by the students and the educators, including the instructions and ability to access and use the learning materials
- The flexibility of online materials and the workload associated with either completing them (students) or developing context specific materials (educators).

Two questionnaires were developed (one for educators and one for students) using guidelines provided in the report by Philips et al (2000). It was decided not to use an online questionnaire because recent research has indicated that a poor response rate of less than 20% is likely to occur with online surveys (Sheard & Markham, 2005). The University of Sydney Human Ethics Committee approved the conduct of the research.

Seventy-eight undergraduate physiotherapy students enrolled in the 3rd year Unit of Study PHTY3053 Musculo-skeletal Physiotherapy C completed the questionnaire (56% response rate). They were asked to complete three different cases as part of this unit of study during the first semester of 2006. Two cases were modeled on the "Efficiency template" and one was modeled on the "Clinical Reasoning template". There was no summative assessment component for completion of these cases; it was promoted by the educators as a useful study tool to gain formative feedback on student learning of course content, and that some content would be covered in the written exam. Students were encouraged to complete the questionnaire in the last teaching week of the semester before the final examination, regardless of whether they had accessed the cases. The questionnaire consisted of 15 questions based on Likert scales or open-ended questions asking learners about both the usability of the cases and value of the cases to their learning in this unit of study.

Preliminary results show that the majority of students (86%, n=67) completing the survey had accessed successfully at least one or more of the cases. Of the 14% (n=11) who had not accessed any of the cases, stated reasons ranged from difficulties having a computer to access the materials, to lack of time. Many stated that they planned to use the cases for revision before the final examination.

In addition educators who were currently using or planning to use the templates in their teaching were also asked to complete a similar questionnaire, the details of which are currently being collected. It was felt that the open-ended questions would enable unanticipated issues to be identified, which is considered an important aspect in the conduct of information and communication technology evaluations (Scanlon et al, 2000).

Conclusion

A key to the smarter use of educational technology in higher education is making the learning materials easy to use and adaptable for different applications, whilst being mindful of the development time required to meet these ideals. Evaluation of educational technology needs to be sensitive to the nuances of the online learning process as well as the usability of the online materials. The results of this evaluation will aim to begin to address these issues and highlight aspects that need further consideration, not just for the use of these templates, but more broadly for dissemination within the institution.

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Learning through online discussions: A focus on discourse analysis and language functions

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This paper examines how an online postgraduate program made use of a discussion forum to engage students in meaningful discussions. The authors aim to capture and extract elements of its success using detailed discourse analysis, informed by systemic functional linguistic (SFL) theory. This involves examining three domains: first, the ideational experience when students construct the content of postings in which they present their social and ideational positions, philosophical beliefs and ideas; second, the interpersonal experience when students construe their social relationship with their readers/audience; third, the textual organisation of their discussion texts in relation to the language patterns and linguistic resources that emerged when their texts unfold. Through detailed discourse analysis, the paper illustrates two examples of the use of hedging and metaphor to provide an insight into the good practice shared by students, and how text functions in online discussions. We find that students, by using various linguistic resources, such as hedging and metaphors, share their experience and pre-knowledge to develop solidarity and authorial voice. In conclusion, the SFL framework presented in this paper provides a valuable tool for the description and analysis of online discourse. However, at the social interpersonal level and the ideational level we need to develop a more comprehensive model for analysing texts generated in the highly complex process in online learning and discussions.

Keywords: online discourse analysis, hedging and metaphor, knowledge construction, epistemic games, epistemic activities, language skills, cognitive skills

Introduction

Learning through discussion is an important part of the design of many online programs (Goodyear, 2003; McConnell, 2000). Online discussions can occur in real-time – when they are usually known as online chats, or synchronous chats (Pilkington & Walker, 2003) – or they can extend over days, weeks and months. Online discussions are thought to mix some of the characteristics of speech and writing. In the case of extended asynchronous discussions, student postings can indeed take on the form of mini-essays, with little of the spontaneity or informality we find in real-time chat. But the emerging conventions of online discussion suggest that such contributions are rarely seen as the ideal or as completely legitimate. Even quite attenuated online discussions, in which students may be posting no more than once a week, turn out to have some of the characteristics we associate with face-to-face discourse. Since language plays a complex, subtle and often taken-for-granted role in online discussion, it seems to us to be worth close scrutiny. It is, after all, essential to processes of joint knowledge construction (Morrison & Colllins, 1996; Ohlsson, 1996) as well as to processes that create and maintain the interpersonal relationships involved in collaborative learning. Students and teachers bring to online discussion a rich array of linguistic resources that can be deployed to achieve quite subtle effects (Goodyear, 2002a).

In this paper we aim to identify and represent some successful elements drawn from an online discussion, using a detailed discourse analysis informed by systemic functional linguistic (SFL) theory (Halliday, 1994; Martin, 1992; Martin & Rose, 2003). The data are drawn from a well-established online postgraduate program. The analysis of students' discussion texts focuses on three perspectives:

1. The ideational experience when students construct the content of postings in which they present their social and ideational positions, philosophical beliefs and ideas;
2. The interpersonal experience when students construe their social relationship with their readers/audience who in this context are their peers and tutors;
3. The textual organisation of their discussion texts in relation to the language patterns and specific linguistic resources emerging when their texts unfold.

We show how students, through the effective deployment of various linguistic resources, successfully negotiate their ideas and arguments by acknowledging the experience and pre-knowledge of the audience. Among other things, their texts also invite their peers/readers into a dialogue by using personal nouns, asking meaningful questions and through the use of subtle techniques like ‘hedging’ to negotiate personal stance and points of view.

Related work: Language and learning

From a socio-cultural perspective, academic learning involves apprenticeship in the construction of knowledge within a community of practice (Bereiter & Scardamalia, 2003; de Laat, 2006; Goodyear, 2002b; Lave & Wenger, 1991). Discourse is essential in such epistemic activity (Ohlsson, 1996). Ohlsson points out that different kinds of knowledge have to be acquired in different ways. Learning *how* to do things involves skills acquisition, practice with feedback, etc. Learning simple facts can similarly be achieved through repetition. Higher order learning, which is implicated in achieving understanding of ideas, concepts and principles, involves discourse. Ohlsson uses the construct of *epistemic activity,* linking abstract knowledge to discourse, as he argues that discourse is a cultural product that embodies abstract ideas when people talk and write. Discourse is the medium in which epistemic activities, such as describing, explaining, predicting, arguing, critiquing and defining, are curried out. In a similar vein, Allan Collins uses the constructs of epistemic forms, epistemic games and epistemic fluency in an attempt to combine sociocultural and constructivist perspectives on learning (Morrison & Collins, 1996). Epistemic forms are the ‘target knowledge-building structures’ used within a culture. Epistemic games are the culturally recognised ways of creating and improving such structures. Epistemic fluency is the ability to recognise and participate in a variety of epistemic games. Again, discourse is central to the playing of epistemic games. Bereiter and Scardamalia (2003) study the role of progressive discourse in producing, critiquing and improving conceptual artefacts. They usefully distinguish *belief mode* and *design mode* in the construction of knowledge. In belief mode, one focuses on the truth value of an idea. In design mode, one focuses on its use and improvability. A connecting thread in the work of Ohlsson, Collins, Bereiter & Scardamalia is the notion that coming to understand involves participation in epistemic activity, mediated by discourse.

Related work: Analytic methods

Research into online discussions has grown steadily over the last 15 years, with a main stream of work being focussed on the analysis of online transcripts (Fahy, 2002, 2003; Hara, Bonk, & Angeli, 2000; Henri, 1992; Howell-Richardson & Mellor, 1996; Oriogun 2003, 2006; Schrire, 2006) and a subsidiary stream using interview and survey methods to research students’ experiences and learning outcomes (Ellis, Goodyear, Prosser, & H’Hara, 2006; Goodyear et al., 2003, 2005). There is still only a very modest amount of research that combines analysis of the transcripts students produce and what students say about their production (de Laat, 2006). There is, however, a growing awareness of the need for better analytic approaches and techniques (Booth & Hulten, 2003; de Laat & Lally, 2003; Felton & Evans, 2004; Schrire, 2006) as well as better theoretical frameworks for understanding the complexities of online interaction, student experience, language and learning (Fahy, 2002, 2003; Oriogun 2003, 2006). A common critique has been of approaches which stop short at analysis of the *quantity* of student postings, word counts, etc. Though qualitative studies may be more time consuming, they are necessary for an in-depth understanding of the essence of the learning experience (Booth & Hulten, 2003; de Laat, 2006; Schrire, 2006).

There is no single research method capable of providing a holistic account of the complexity of the online discussion process. Work by de Laat (2006), and de Laat and Lally (2003) stands out as an example of a multi- method approach, using content analysis, critical event recall interviews and social network analysis. Booth & Hulten (2003), in a different way, stands out as an exemplary approach to identifying critical learning moments in online transcripts. By applying methods of Practical Inquiry (PI) and a Transcript Analysis Tool (TAT), Fahy (2002, 2005) shows how one can identify different levels of critical thinking in transcripts. Oriogun (2003, 2006) provides an example of how one can measure online learning levels of engagement, with a focus on interaction, participation and cognitive engagement. While each of these open up possibilities for obtaining a deeper understanding of how online learning has taken place, we would argue that methodological developments in this area are still at an early stage. Our own work is, in part, a contribution to methodology as well as to substantive issues in the field.

The systemic functional linguistics (SFL) framework

SFL was developed drawing on the early work by Halliday (1974), Halliday and Hasan (1976) and Martin (1992). It is concerned with three social functions of social experience (ideational meaning), social relationship (interpersonal meaning) and textual representations (textual organisation) (Halliday, 1994; Martin, 1992; Martin & Rose, 2003). As we argue, the quality of student written texts contributes greatly to the quality of their discussion contents; we need ways of describing and analysing these texts to capture good practices. The main contribution of the study is the modeling of the SFL framework for explaining how students use text as a key medium to develop their capacities to share new ideas, concepts and values in their discussions.

The discourse analysis examines three domains of texts. The first domain is how students construe their social experience and conceptual understanding in the subject being discussed - for example, how they represent their philosophical beliefs and arguments. The second domain is the social functions of student texts - how they affect readers' feelings in order to influence acceptance, build solidarity and a constructive relationship in a dynamic group. The third domain is the textual organization of student texts. What are the emerging language features and patterns used by students? What language choices have they made in order to argue and clarify a philosophical position or elaborate an incident?

Study approach

In performing the discourse analysis for this paper, we have taken sample messages from selected threads rather than sampling across all threads. We are not aiming to characterize all of the discourse in the course we were investigating. Rather, we want to use selected examples to illustrate some of what can be gained from this analytic approach. This allows us to look at key evidence in the use of cognitive skills and languages functions in some key moments in the discussion, demonstrating how important these key moments are in shaping the dynamic of the discussion group. The detailed discourse analysis approach enables us to describe how texts play an important part in the discussion process and how students use different language choices to convey meanings and construct their group interaction. Due to the limited space available, the analysis will use two examples from the data collection. One example focuses on how *hedging* is used to acknowledge audience and provide space for negotiation. The other example follows the evolution of a metaphor thread in a key passage in the online discussions.

Data source: An established online postgraduate program

The postgraduate program providing data for this study has been making extensive use of online discussions since it began in 1989/90. Most of the students on the program work in the field of learning technology, working as educational designers, online course consultants or online professional trainers. They are part-time students, spending a small number of hours each week engaged in online study activities. The course design gives them a clear mandate to draw on their work experience in the learning activities.

We explore the following questions:

1. What are the distinctive language skills being used by students in their forum discussion?
2. How do these skills help students better interact with their fellow students?
3. How different language resources are deployed to help student develop ideas, concepts and knowledge in an online discussion environment?

The data come from the first four weeks of a course unit concerned with the psychology of learning. Most of the students have studied other units on this program prior to their involvement in the unit we analysed. Students were set the task of making four postings to the discussion in the first four weeks. They were asked to post (i) a personal definition of learning; (ii) a description of ways in which it can be determined whether learning has or has not taken place; (iii) a description of their current job, tasks/projects they typically undertake at work; (iv) a description of a specific job they have to do that is directly concerned with supporting other people's learning (ALT01, 2003).

There were nineteen students on the class list and the following table shows how the students' postings are distributed over the first four weeks.

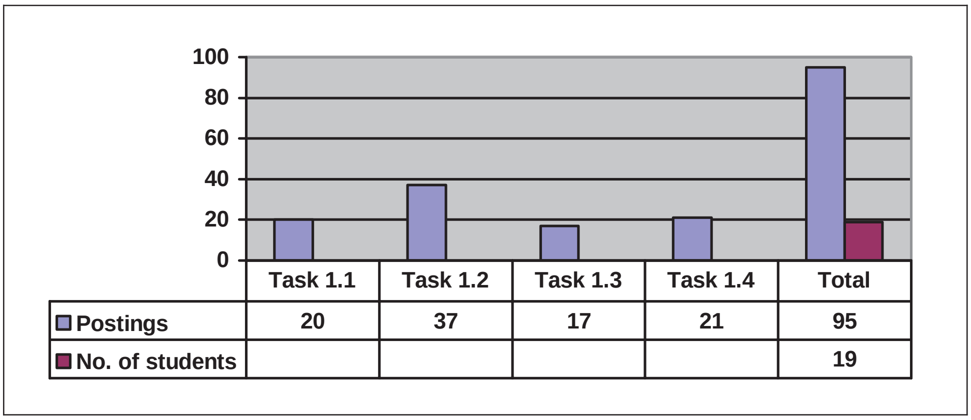

Figure 1: Student posting distribution among different activities

Figure 1 above shows that postings are quite equally distributed among the four tasks except for task 1.2 which has almost twice as much as the other tasks.

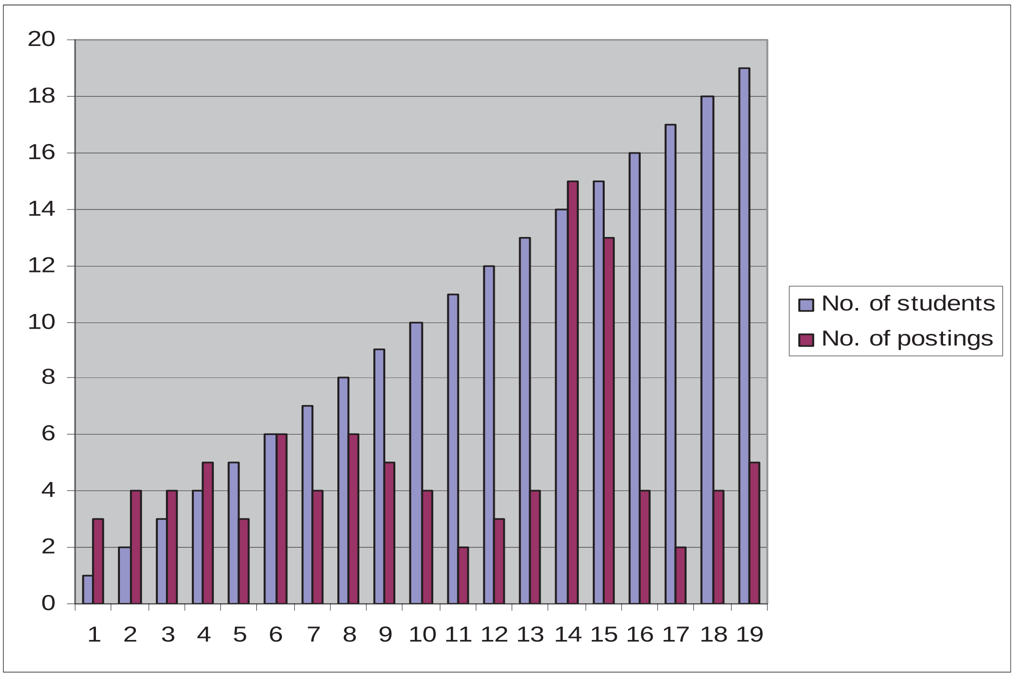

Figure 2: Individual student postings

Figure 2 shows that the number of postings varies significantly between students. It ranges from the most active student who posted 15 messages to the least active student with 2 postings. But counts of postings are not an adequate way of evaluating students' level of participation. In the following we aim to use detailed discourse analysis, guided by SFL, to reveal the content contribution of selected student texts. Our first example looks at metaphor.

The use of metaphor

Table 1: Example of metaphor entries (pseudonyms are used)

Student	Xing (Starter of metaphor)	Hana to Xing ←	Paul to Xing & Hana ←	Ann to Hana ←	Hana to Ann & Paul ←	Peter to Hana ←	Paul to Ann ←
Subject heading	Definition of learning	Metaphor	Re: Definition of learning	Re: Definition of learning	Re: Metaphor	Re: Re: metaphor	Re: Metaphor
Idea being discussed	Propose metaphor: Learning is like a city and it is lifetime.	Compliment of Xing's city metaphor. Propose learning as water, liquid, fluid and messy	Compliment of Xing and Hana's city and water metaphors. Extend water metaphor: water moves around, may not flow where it does us most good, so education is channelling and shaping.	Compliment of Hana's water metaphor. Propose learning as jigsaw puzzle without a blueprint. It is about fits of shape, size and colour	Compliment of Ann's jigsaw puzzle. Link Ohlsson's abstract knowledge. Responds to Paul's previous idea of learning and chaotic.	Compliment of water metaphor, and proposed water with different qualities	Compliment of Jigsaw metaphor. Extends concept of collective learning within the community
Language Skills/functions	Presenting and describing new idea	Complimenting and extending idea to a new form	Complimenting/ extending idea	Complimenting & proposing new metaphor	Complimenting & making connection of idea	Complimenting/ extending idea	Complimenting/ extending idea

From Table 1, we can see the pattern of turn-taking in part of the metaphor discussion. The discussion is non linear and has some of the multi-directional interaction we find in face to face discussions.

Xing's metaphor of *City* generates an active discussion in the group. She has received direct and indirect responses from her peers, complimenting her use of the metaphor. Also her metaphor has encouraged her group members to generate alternative metaphors of *Water* and *Jigsaw puzzle* in their discussion. This in turn has created an in-depth elaboration of 'learning', with vivid descriptions and the forging of connections with real life. For example, water is liquid, fluid, can overflow, can be channelled and has different qualities. This is contrasted with the image of a city as strong, solid and lifelong. Jigsaw puzzles consist of many different shapes, colours and they need collaborative work to put them together to form meaningful pictures.

The deployment of such metaphors has enhanced the description of learning which also demonstrates students' in depth conceptual understanding and their ability to apply their cognitive and language skills to illustrate a highly abstract concept. Another effective use of their metaphor is the students' skills in contextualisation. They are able to place these metaphors within the context of learning and how learning takes place, which is within the set scope of the discussion topic.

Sample of text analysis

The following looks more closely at Hana's text:

> Learning is to do with bringing about an 'improved' (now there's a piece of string to follow!) changed state in one – or a combination of – the following:
>
> Understanding, Familiarity with something (incl. Remembering), an ability to do something. It may be conscious or unconscious. It may not be tangible. It is not static. It is not stable. As such, determining if learning has taken place, is an approximate game. Probably the most telling way is first to ask the student, then to ask the student's peers and tutor.
>
> 'Assessment' MAY reveal if learning has taken place, but (by definition) reveals what is measurable within its prescribed format and is more often concerned with measurement against a standard, not against the point from where the student began.

Hana uses different strategies in developing her arguments when constructing the text. When defining learning, she uses a statement: ***learning is about changes*** to preface the remainder of the text. She then uses elaboration strategies with a list format to extend her concept of changes in the cognitive domain of learning: ***understanding, familiarity and ability***. She then further explains the different forms of changes, using the technique of repetition and contrast, for example, ***It may be … It may not be. It is not… It is not***

Similarly, she skillfully applies metaphor to describe ***determining if learning has taken place*** as an approximate ***game***. By using such a metaphor she indicates her position and concerns about any standard measurable form of assessment. She then proposes an alternative approach to assessment and in the meantime takes the opportunity of evaluating the disadvantage of standard assessment methods. She argues that it ignores the crucial consideration of where the student *began* in reaching the point where they are now. In the second activity, her approaches are much more strategic, with well sequenced arguments and logical organisation.

Here we also see that Hana makes a semantic link of the *approximate game* metaphor to the practice of peer review and more formal assessments. It is an approximate game therefore it is more appropriate and reasonable to ask students, peers and tutors. However, in contrast to the metaphor she raises her concern of formal assessment in determining if learning has taken place. Such a multidimensional approach in presenting arguments requires a much higher order of language skills in developing this non-linear meaning making and textual organisation in the critique process.

Another strong feature in Hana's text is her use of *hedging* in presenting her arguments. According to White (1998) a writer uses hedging (e.g., maybe, I think that…) to indicate a lack of commitment to its proposed content. It allows the writer to negotiate the true value of the content at an interpersonal level with the readers. For example, Hana proposes that *learning maybe conscious or unconscious*, as she is not committed to either. She presents the concept for negotiation to allow the flexibility to suit different learning contexts and experience. By using the modality of *probably* and *may*, she also indicates her non committal position towards using formal assessment to determine if learning has taken place. The modal word *may* is written in upper case (*MAY*) to highlight her doubt and unwillingness to commit to prescribed assessment. In the meantime, while expressing her non committal attitudes she proposes an alternative - using measurement *against the point from where the student began.*

When negotiating her authorial position, Hana has skillfully used both stance and engagement. In her first sentence she uses a statement of approximate game to assert her position that assessment in learning comes with a variety of methods depending on what is being assessed. Then, she proposes two possibilities to allow her fellow students (audience) to make their own judgment and interpretations. By acknowledging her readers' (fellow students) presence, instead of making a firm statement of her position like her first sentence, she reserves her authorial position by using modality *may* to indicate her willingness to hear other students voice. It is an invitation for other students to confirm or rebuff.

Table 2: Summary of analysis of Hana's text within the SFL framework

Ideational meanings (Field)	Subject contents: Learning is about an improved changed state, a combination of understanding, familiarity and an ability to do something
Interpersonal meanings (Tenor)	Authorial voice: Hedging & modality to allow engagement and negotiation by using probably, may, may not.
Textual meanings (Mode)	Sentence patterns: *Learning is …. It may be …, It may not be …* Conjunctive link: *but.* Nominalisation: *combination, familiarity, ability, assessment, measurement* Contrast: *It may… it may not … conscious/unconscious, static/stable* Other features: *first … then …. Probably, often, may*

Implication and conclusion

The paper has presented both the results of counting of student individual postings and detailed discourse analysis of student texts. The later is necessary for an in-depth understanding of how the rich language repertoire underpinning students' texts enables them to deploy different strategies and resources in their interaction and knowledge construction. The multi-dimensional construction of meanings demonstrated in students' texts, such as hedging and effective use of metaphors, has contributed to the high quality of discussion and the complexities of ideas and concepts being discussed. The understanding of such language apprenticeship is essential in educational design in order to better support students' learning experience in online discussions.

In conclusion, detailed discourse analysis informed by SFL is valuable approach to online texts analysis. However, the SFL framework presented in this paper needs further development in order to provide a powerful tool for the description and analysis of online discourse. In particular, at the social interpersonal level and the ideational level we need to develop a more comprehensive model in analysing how social functions are realised by making language choices in the highly complex process in online learning and discussions. The work presented in the paper has made a key contribution to this area in providing future researchers with a new direction and theoretical framework.

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Teaching through technology-enhanced environments in higher education: Moderating for effective computer conferencing

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The emergence of the 'knowledge based society' places extra pressure on university teachers to develop students' knowledge and skills. Although focus has shifted from teaching to student centred-based learning it is still useful to investigate university teachers' approaches to teaching through networked technologies. Previous research indicates that the success of the online activity is influenced by the person who organises and facilitates the discussion (Berge & Collins, 2000). The role of the leader or 'moderator' in motivating the participants, channelling the discussion and deliberately handling difficult situations is crucial. The recognition that the moderator's work makes a great difference to the success of computer conferencing creates a pressing need to research new approaches to teaching online. Located on the socio-cultural framework, this study suggests that the moderator's role is crucial in sustaining conferences through the structuring of the learning resources inherent in the conferences.

Keywords: online teaching, moderation, computer conferencing, situated learning

Introduction

The sociocultural framework of human development proposed by Lave and Wenger (1991) starts with the assumption that engagement in social practices is a central process by which humans understand the world. The term 'community of practice' implies participation in a system through which learners share understandings concerning what they are involved with and what that means in their lives and for their communities (Lave & Wenger, 1991). Issues of negotiation of meaning, reflection over practice and identity are pertinent to this account of situated learning. An important element for increasing participation is the 'transparency' of the organisation of practice, the resources and the artifacts used in the process. The notion of transparency refers to the ability of the participants to make sense of everything that is engaged in the process (Wenger, 1998).

Within a community of practice, the participants' access to learning resources is closely linked with the role of the 'master'. The role of the 'master' is placed in structuring the learning resources of the community rather than transmitting knowledge (Lave & Wenger, 1991). Similarly, the learner within the community of practice is not required to model the performance of the master, but rather engage in the processes of the community. In that sense, the 'master's' role is placed in enhancing learners' participation in such a way that development can be achieved. The effectiveness of masters within a community of practice is not dependent on their ability to instruct students with their own conceptual representations. Rather, it depends on their ability to manage effectively students' participation into the community. Any authoritative behaviour from the part of the 'master' interferes with the participants' engagement with the processes of the community and, subsequently, it may interrupt learning. Lave and Wenger (1991) see a decentered view of master–apprentice relations where mastery is the organisation of the community of practice of which the master is part:

> The master as the locus of authority (in several senses) is, after all, as much a product of the conventional, centered theory of learning as is the individual learner. Similarly, a decentered view of the master as pedagogue moves the focus of analysis away from teaching and onto the intricate structuring of a community's learning resources. (Lave & Wenger, 1991, p.94)

Research on computer conferencing moderation suggests that the moderator should act as a facilitator of learning rather than an authoritative teacher transmitting knowledge. Mason and Bacsich (1998) suggest effectively handling questions and responses as well as providing resources, learning materials and supportive media. They suggest that online discussions should be structured as other parts of the course to include paced activities, exercises and set tasks: however, they argue that in practice it is very difficult to establish educationally valuable discussions (Mason & Bacsich, 1998). Enhancing the social cohesion of the group can play a big part in the creation of a successful educational environment and this can be achieved through the establishment of a climate of rapport and co-operation among participants (Mason & Bacsich, 1998; Wilson & Whitelock, 1998). It has been suggested that the moderators need to employ social, leadership and interpersonal communication skills in order to be competent in working with people online in a creative and supportive way (McConnell, 1994; Haughey & Anderson, 1998). Gilly Salmon in her influential book on e-moderating introduces 'weaving' as a key skill for creative rearrangement and connection of important themes discussed by participants (Salmon, 2000, p.155). Goodyear et al. (2001) provide a useful framework for roles and associated competences for online teaching for networked technologies.

This paper extends research about the perceptions of teachers using this medium and the strategies they employ in teaching through computer conferencing to avoid problems encountered by students. It provides a framework of educational techniques proposed by moderators of asynchronous computer conferences and argues that their role is placed in enhancing learners' participation through making transparent the resources used in the process of computer conferencing in order to enable student-teachers to become full members of the activity and to develop an identity.

Methods

The study used qualitative forms of data analysis in order to engage in interpretation of the phenomena allowing carrying out thorough checking of the descriptions produced and eliminating complexity through in-depth analysis. The problem under investigation focuses on the approaches and experiences of the university teachers engaged in the processes of computer conference moderating. The study focuses on the OU PGCE, which is the largest pre-service teacher training programme in Europe and it is provided from the UK Open University – a distance learning institution that has been a model in providing open learning programmes and utilising CMC technologies. Eight university teachers acting as conference moderators have been interviewed. The interviews with the moderators were conducted face-to-face and they lasted from thirty minutes to one hour and 15 minutes. The questions to the moderators covered a wide range of themes including visualisation of conference participants and rooms, asynchronicity, and ways of enhancing participation and techniques for resolving problematic situations. I sought, in particular, the interviewees' opinions on the qualities and skills of successful moderators and I encouraged them to reflect on their own moderation and discuss the particularities of their own conference rooms. The interview data, along with the computer conferencing messages exchanged, provided a rich pool of information for the study of computer conference moderating. Data were collected from five PGCE computer-conferences and was triangulated with data collected from 41 students.

Strategies for online teaching

The two aspects of the online teaching process concern a) the building of a sense of a community and b) the promotion of students' involvement in reflective discussion. Table 1 outlines the strategies used by computer-conference moderators in order to build a sense of a community within a computer conferencing network, in particular, at the beginning of the activity.

There is evidence that there was a link between establishing aims and moderating successful computer conferences. The moderators have used the setting up of the tone of the computer conferences observed in this case study as a strategy aiming to build a sense of a community. The term 'tone' refers to the general character of the online event and to the atmosphere within the computer-conference, which are shown through the manner of expression in the messages sent. The moderators' 'welcome' message, which was the first electronic contact with the students, established the tone of the computer-conference. The setting of the tone is important in terms of allowing access to the students. Access to the wide range of the on-going activity and the learning resources of the computer conferences enables the participants to move from peripheral participation to more legitimate forms of participation in the community of practice. Being directly involved in the scope of activities and sustaining relations with the people that participate in the computer conferences enables engagement to emerge as a source of identity. In that sense, access is key to understanding and learning; any problems that obstruct access interfere with learning. Problems of power are sometimes interconnected to problems of access and need to be dealt through effective management of communication among participants.

Table 1: Strategies for building a sense of an online community

Strategy	Representative quote
Clarifying the aims of the conference	Mainly it's my job to make them think about their scientific knowledge, although that's the minor of the two really. […] my major point in professional development of the teachers is to get them to share their own expertise but get them to reflect then on how that is different in the different schools, because people are coming in different ways and how then that relates back to the course materials they would have read.
Setting up the tone	I'd like to set up an ethos that's welcoming, that's warm, that values contributions but it is also critical, analytical, questioning. So to get the students to feel that it's OK, to say I disagree with that but as long as they give a reason and so that isn't a disagreement, is an intellectual debate. And I think it's really an important for teachers, to engage in that sort of discourse so that they create hopefully that sort of discourse into the classroom.
Establishing the netiquette	The other thing I think is making clear the ground rules in which people operate. So, that would be at the beginning of the outset […] about asking questions, being collaborative, always introducing a topic clearly, so all those things I think are also important, and modelling them yourself.
Knowing students	Getting to know the students first, getting to know what interests they have and so that you can, if possible draw on that, but most especially so that the whole group knows what the knowledge is and interests and skills that the whole of the group is bringing.

Similar to all social settings, the moderators identified a need for establishing codes of conduct within computer conferences. The introduction of 'netiquette' as a set of established rules for the behaviour of the participants in the conference, and to the issues of establishing a sense of collaborative community online, has been even more crucial within the electronic environments because of the absence of visual cues and non-verbal exchanges. A set of ground rules clarifying the rules of operating within the computer conferences were introduced as a means to establish the netiquette: a) providing a precise title for each message, b) informing the computer-conference about their interests, c) keeping the discussion focused on professional issues, thus sending personal messages to personal mail boxes and d) sharing resources within the appropriate sub-conference room. Although all moderators introduced the 'netiquette' at the beginning of the computer conferences, problems appeared when users did not follow the ground rules. Within the computer conferences observed, the problems were related to certain features of computer-mediated communication: i) the openness of the CMC environment and ii) the textual nature of CMC.

There is evidence that knowing students helped all the participants, including moderators, to build a sense of a community within the computer conferences. Knowing the students that participated in the computer conferences allowed the moderators to draw on their interests and expertise in order to enable them to participate more actively and to contribute to the ongoing discussion. Within the case study, this problem was solved through the use of the 'resume' function and through students introducing themselves. The resume allows the computer-conference participants to circulate a short biography online. This information can be easily accessible when one is connected to the network simply by double clicking on the name of the sender at the top of each message. There is evidence that students used the resume feature as a way to introduce themselves and find out about the other participants in the conferences. In fact, within the Science and the English conferences students' introductions were encouraged at the beginning of the computer conferences. Later, when the computer conferences had progressed the moderators used the following strategy; they grouped all students' introductions in a different sub-conference, which they called 'Introductions'. The effectiveness of the 'Introductions' space was enhanced by its logo that depicted faces. This strategy allowed students to retrieve and read the messages whenever they wished to recall the details of the people they were talking to. As a technique for structuring the discussions has been the organisation of the conference environment in such a way that it is made up of a main conference and a number of sub-conferences. The sub-conferences can be set up in order to provide an 'area' where specific subject discussions may happen. This helps students conceptualise the 'space' of a conferencing system and find their way around its facilities.

Table 2 provides a set of strategies used by the moderators in order to engage students in reflective discussion. The first six strategies indicate moderators' intention to promote students' higher order-learning as they can be linked to Ohlsson's taxonomy of epistemic activities: describing, explaining, predicting, arguing, critiquing, explicating (i.e. engage in discourse to seek clearer understanding of a concept) and defining (Ohlsson, 1995, p.51). Within the conferences, a number of tasks, ranging from general to more precise, being related with developing competences of professional teaching were set by the moderators. Students, for example, were asked to describe and explain episodes from teaching practice, predict situations when planning a lesson and critique ideas especially in response to the papers initiated by guest speakers. On a few occasions students showed a higher level of abstract thinking, which was evident within reflective shared messages in which they explored concepts and formulated personal theories of teaching (Zenios et al., 2004).

Table 2: Strategies for promoting student involvement in reflective discussion

Strategy	Representative quote
Creating a culture of enquiry	One of the things that I've thought about a lot, is how to create a culture within the computer-conference that is an enquiring culture […] It's the use of questions rather than statements to provoke discussion and debate. And one of the things that underlines that is my view, my philosophy of education which is that students should above all learn to be critical and inquiring and to pose problems and questions, to ask philosophical questions or practical questions.
Keeping the discussion focused	I think probably the ICT in Science was the most successful and that was because it was something that was formally set up, that they had to do something.
Motivating students	I pose questions that are related to students' interests and needs E.g. I sent a message asking questions about the teaching of phonics and then we had a reflective discussion within the 'On-Line Seminars' room.
Encouraging students to contribute to the discussions	I tend to send personal emails to students asking them to share their experiences with the rest of the team, discuss aspects of teaching practice, describe a successful lesson.
Initiating new discussions when there is silence	I think that you also have to be quite inventive to move on the computer-conference when it has become stagnant.
Initiating discussions on important themes and creating separate areas for	One is inviting them within an environment to explore things and making space for that. So, e.g. in the English computer-conference one of the areas that English students have lots of problems with teaching poetry, they find it quite a challenge, is often something that they're not too confident about. English teachers often love poetry. So, one of the first things I do is to set up a poetry computer-conference.
Inviting guest speakers	I introduced a speaker from 'X' University, an expert on the use of IT in science lessons and provided a paper as an attachment.
Dragging successful discussions on separate areas	While you've got a really good debate going on it's quite useful to drag it into another area so that people not forget about it and they can come back to it.
Limiting the asynchronicity of computer conferencing (delaying response time)	I opened a conference to general discussion ten days after [provision of materials] when most people have had a chance to look at the paper.
Being aware of the time-frame of computer conferencing	If I was planning a computer-conference on a subject I would say to the students: 'This will last for a month'. And in my head I'm thinking if it was a face-to-face thing it would be an afternoon. […Similarly] a five minutes silence in a seminar I think it's probably a five days silence in the English computer-conference.

The last three strategies (see Table 2) involve some organisational activities relating to the special character of computer conferencing. The asynchronicity of computer conferencing, for example, was limited by asking participants to wait for a certain time before responding to the questions posed aiming to reduce the impact of those participants who dominate the discussion and encourage those who are reluctant to contribute. Appreciating that time has a different dimension in the online environment than the conventional classroom has implications for the success of the online discussions.

A useful strategy for stimulating the discussion has been to invite guests who submitted papers in the computer conference and participated into the discussions that followed. The papers initiated discussions which engaged students throughout the conferences' life span (see Table 3). There is also evidence that student teachers linked this discussion to their teaching practice.

Table 3: Initiating discussions

Computer-conference	Space	Discussion theme	Contributors*	Messages sent (total)	Messages sent by the moderator	Duration
Science A	IT in Science	Use of ICT in Science lessons	18	31	2	8 months
Science B	ICT in Science	Use of ICT in Science lessons	27	40	6	5 months
English	English Comix	Use of Comix in English lessons	8	23	4	5 months

Note. *The term 'contributors' refers to the senders of messages, because in reality many more people participated in the discussions as readers.

The views presented above underpin the fact that the computer conference moderators saw learning as a decision making process that reflected the personal and motivational issues that participants experienced. In that sense, the moderators did not see learning to be concerned with the transmission of knowledge and the development of some skills, they rather aimed towards developing certain qualities such as reflective practice and learner autonomy (see Zenios et al., 2004). Students were invited to take an active role to these procedures with growing responsibility within the community as well as an increasing identity as developing teachers. The structuring of the learning resources of the conferences coming from course materials, a range of professionals participating, placement schools, knowledge, experiences and skills of participants is seen as a key process in facilitating powerful and effective learning procedures.

Conclusion

This study brings forward teachers' views and approaches to online teaching. Their role is seen as a facilitative one, specifically understood in structuring the discussions and managing participation to allow participants to shape their learning curriculum based on their needs and interests as developing teachers. Thus it provided facilities that supported engagement, exploration of concepts and ideas and reflection on teaching practice. Students constituted the learning resources of the online community through their membership as the ideas exchanged, the knowledge shared and the mental activity involved in computer conferencing came from them. In this respect, this view underpins the need to take an indirect approach in educational design in higher education, in terms of recognising teachers' inability to rigidly design and control student learning activity (Goodyear, 2002). In thinking about teaching online we need to appreciate the extent to which moderators can influence the character and the processes of computer conferences. In the same spirit, the framework introduced here has implications for the composition of learning communities suggesting that computer conferences can be designed as having characteristics conducive to the emergence of an online community and then being made available to active participants engaging them into the creative process of developing learning communities.

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Analysing teaching design repositories

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We describe a software application that supports teaching, research and administration by integrating a teaching design repository with a statistical reporting tool. In this paper we describe a quantitative approach that supports institutional collaboration and the assurance and improvement of quality teaching. The tool analyses key features in unit of study outlines and synthesises the information. Most data are collected from internal administrative processes within the faculty. The prototype system is designed to present various kinds of information from the different points of view of students, academic staff and academic managers who have access to information produced by the reporting tool.

Keywords: quality teaching, reporting tool, statistical analysis

Introduction

Improving the quality of teaching practices within an organization is a difficult task. Several authors have discussed different approaches to quality assurance, their philosophical underpinning and their benefits (Barrie, 2003; Biggs, 2001; Ramsden, 2003). In this paper we discuss a software application built as part of a quantitative approach to supporting quality teaching. The application has a focus on helping teachers in the process of designing and managing units of study and in modelling the institutional approaches to teaching design, instead of institutional approaches to administrative tasks. Until recently, the statistical analysis of how units of study are taught in an academic unit was hard, mostly because this data was not easily available, so only individual research studies could be performed. In a recent project at the Faculty of Engineering, University of Sydney a Unit of Study database was built (Calvo et al., 2005) and all the teaching design information is managed there. Once the information is stored in a database, it can be made available in new ways to support quality educational design. Academics can compare their designs over time or with other strategies; Teaching and Learning committees and educational researchers can review design trends or identify designs that are particularly successful; staff can communicate curricula information to students in more effective and innovative ways (e.g. via visual or interactive representations of units or degree pathways.)

Teaching has always been one of the major functions of universities in Australia and, together with research, teaching is the lifeblood of university life for both academic staff and students (Lally & Myhill, 1994). The importance of good teaching, both in its own right and as a basis for encouraging independent learning beyond the defined curriculum, has been recognised for many yeas as one of the fundamental aims of higher education (Linke Report, 1991). Currently, educational researchers propose different approaches to ensure the quality for teaching and learning. According to Biggs (2001) there are three stages in the reflective practice of an institution: a quality model, quality enhancement and quality feasibility. These three are the essential ingredients in the prospective quality assurance model we use here.

Other researchers have developed ideas to embody the student-focussed learning perspective and look into university policy (Barrie & Prosser, 2003) and its implications to further enhance the quality of teaching and learning. A method by which a university can a combine students' survey data with information from other sources to enhance the quality assurance is described by Ramsden (2003). A web-based mapping tool (Lowe & Marshall, 2004) is shown to inform staff development strategies to facilitate reflection and renewal of curriculum for both individual units and courses of study. Most traditional research and review into the quality teaching concentrate on the student questionnaire of teaching, there are however others resources we need to take into account carefully. We describe a quantitative approach to provide the curriculum information for enrolled students and academic staff and the strategic support for the decision-maker based on the collected data. Laurillard (2002) describes a related model for institutional infrastructure that supports her conversational model at the institutional level.

The purpose of this paper is to describe a reporting and statistical analysis tool designed to improve teaching design, and use our faculty as a case study. The tool uses unit of study outlines and other information collected from academics for compliance with the university and faculty teaching and learning policy. The reports present a summary of key features in educational design. By looking at the extended academic unit and its organization infrastructure we aim for the tool to also show the linkage among different activities (research, teaching and administration) in which staff are normally involved and the way to manage these effectively. These activities are not improved by the tool itself, but by the processes it supports.

The remainder of this paper is organized as follows. In the next section, we address the institutional context and factors determining the quality teaching ‘measures’. Then we describe the application and some of its technical implementation details. Next, our Faculty experience is used as a case study on the basis of analysing the key features of quality teaching and some of the interesting results derived from the interim data collected. Finally, some concluding remarks are given in the last section.

Institutional context and factors

The institutional background

Universities are considered ‘learning organizations’ when they conduct an internal learning conversation that allows them to learn from experience and adapt to the environment (Laurillard, 2002). From the institutional perspective, the learning organization is expected to make its parts coherent and coincident and run efficiently and effectively. Teaching quality is not separable from the department or discipline area, infrastructural and administrative context in which it is embedded (Lally & Myhill, 1994). The gap between teaching and research has been reduced in universities that encourage their academic staff to engage in both teaching and research activities. By doing this institutions expect that academics will keep the units of study they teach updated with current research, that more practical results will be taught to stimulate the students’ motivation and that the close synergy between research and teaching will ensure that a university remains a true centre of learning (Laurillard, 2002). Following this integrative approach we have designed statistical reports of three types of measures: teaching, research and administration, with a focus on the first area.

Additionally, academic management is also a key to influence teaching. Management must look into staff development programmes, teaching workload, reporting within and outside the university, and resource allocation for new staff and new infrastructure. The staff development programmes help raise academics’ awareness of current teaching practices, new teaching technologies.

Key measures of quality teaching

Generally speaking, there are no quantitative instruments that can be applied to all universities. Each one has a different context, a multiplicity of quality attributes defined within each department, and each academic unit or university will use different measures of quality based on their particular institutional background. We have identified five essential features on the basis of the quality teaching dimensions (Lally & Myhill, 1994) for which we collect information: teaching methods, learning approaches, assessment methods, graduate attributes, and curriculum design (Table 1 and Table 2).

Good teachers are expected to use a variety of appropriate teaching methods that help students develop ‘graduate attributes’, such as critical thinking skills and judging the evidence to make conclusions. There is great difference between disciplines with respect to the distribution of teaching methods used to develop these and other graduate attributes. In some disciplines teachers prefer lectures, in others they might prefer laboratory work, using computers and electrical equipment as an instrument used in the departments emphasising the development of practical skills. Most teachers are inclined to apply several teaching methods rather than a single method. They also adapt the teaching methods to the group of students. First year students are more likely to benefit from methods that provide additional scaffolding, and the senior students from more independent study.

Other teaching design decisions, such as assessment methods, are key points to understanding the process of students’ learning, since they are the drivers to how students go about their learning activities.

Teachers must decide on assessment methods and the weighting they give to each. Both variables are important and can be used in a statistical analysis of institutional approaches to student assessment. This analysis can then be used to evaluate the impact of new policies, trends, staff development programs, etc.

Table 1: List of key features and examples for quality teaching

Key features	Examples for key features	
Teaching methods	Lectures	Laboratory work
	Tutorials	Project
Learning approaches	Independent study	Exercises
	Discussions	Field trips
	E-learning	Consultation
Assessment methods	Quizzes	Laboratory performance
	Final exam	Participation and attendance
	Presentation	Assignment submission
Graduate attributes	Information literacy	Personal and intellectual autonomy
	Research and inquiry	Communication
	Ethical, social and professional understanding	
Curriculum design	Curriculum content	Curriculum workload
	Weekly assessment	

Table 2: List of main analysis approaches for quality teaching

Key features	Analysis approaches	
Teaching methods	Popular teaching method	Joint teaching methods
	Department-wide teaching method	Annual teaching method
Learning approaches	Popular learning approach	Joint learning methods
	Department-wide learning method	Annual learning method
Assessment methods	Popular assessment method	Joint assessment methods
	Department-wide assessment method	Assessment method weighting
Graduate attributes	Popular graduate attributes	Joint graduate attributes
	Department-wide graduate attributes	Graduate attributes level
	Average graduate attributes	
Curriculum design	Weekly curriculum schedule	Curriculum load level
	Student workload	Frequency of unit of study revisions
Linkage of features	Linkage of teaching and learning	Linkage of teaching and assessment
	Linkage of teaching and graduate attributes	Linkage of assessment and graduate attributes

The analysis may have many other applications. It has become increasingly important to identify the graduate attributes developed in each unit and course of study. Detailed descriptions are required by accreditation institutions and by academic management. These skills are considered important for students to make the successful transition from the university to the workplace. For the units of study focusing on developing critical thinking and problem solving skills, a high level of research and inquiry focus is required to reach the aim. On the other hand, the attribute of communication is much needed in dealing with the unit of study whose objective is to communicate clearly and effectively. The statistical analysis (e.g., average) for the graduate attribute in department-wide or stream-wide constitutes a fundamental evidence to gain insight on the generic skills developed.

The curriculum design is another dimension we take into account to investigate if the curriculum planning fits well with other units of study and the level and difficulty of workload is appropriate. Our application design also provides statistical analysis of workload data because this is a common area of concern amongst engineering students and academics. A fully articulated syllabus with a balanced workload produces useful information leading to better learning for students.

The relationship among the key features mentioned above is another factor to observe. They must be linked together to support quality teaching. One example of interaction is the choice of teaching methods and its alignment with the learning approaches and assessment methods. To some extend the teaching objectives and method, and the corresponding assessment determine the way students learn.

Key features describing research and administration

The second and third areas that our tool aims at are research and administration, as they are believed to influence quality teaching. Research projects and their funding are critical parts to describe research activities in an academic unit. The number and the size of grants and scholarships received are often used as a simplified measure of the research team achievement and contribution. In addition, the quality and quantity of publications also determine the research achievements (Table 3).

The management of human resources consists of the staff components, the ratio of staff and students, staff workload and their professional development strategy. The academic, general staff and managers playing different roles are working in a coordinated way to ensure quality teaching and the efficient organization. Our faculty has carried out a variety of activities to enhance the staff development such as training activities and seminars (Table 3).

The reports can also help with resource allocation. The unit of study database provides us with the overall picture of a range of courses offered by the entire department and/or faculty. The proper distribution of the units load including the core, recommended and elective for every year and semester will affect the academic staff and students' workload. The sharing of the units is found across the departments and streams and resources reallocation will possibly occur with respect to the students, staff and facilities. The other administrative issues emphasising on the learning resources management and the curriculum revisions are required to be recognized. The updated curriculum design can reflect the current knowledge structure and encourage the students to engage in the unit of study learning (Table 3).

Table 3: List of main analysis approaches for research and administration

Key aspects	Analysis approaches	
Research	Research project	Research population
	Funding and grants	Contribution
	Publication	
Administration	Unit of Study (UoS) load	UoS status
	New UoS planning	Shared UoS
	Textbook list	UoS data collection
Human resource	Staff member component	Staff workload
	Staff–student ratio	Staff position
	Staff development strategy	

Application and software implementation

Our application is implemented using the OpenACS web application framework (Calvo & Peterson, 2002) using AOLServer, Tcl programming language and PostgreSQL database. It is based on Curriculum Central (Calvo et al., 2005), a system for managing Units of Study outlines, and is made available to other institutions as open source. The reporting tool discussed here produces diverse kinds of analysis reports including teaching, research and administration. It can be divided into three modules according to the provided functionality: the first level of function is presented for the current students to access the faculty-wide units of study in visual and graphical style. Students can view a specific course structure, understand the relationships between the different courses, learn about the graduate attributes developed and detailed information in each unit of study. The second level helps the academic staff to create, design and review all the processes of teaching to make sure it provides a suitable environment for the students to learn and in the meantime it allows a space for staff to supply the data related to the research and administration. The information includes syllabus, teaching methods, assessment methods, graduate attributes, teaching and learning research projects, funding and staff development. All the summarized and strategic information with quality teaching centred is indicated in the third level based on the reporting tool. The internal data obtained from the staff and the potential external resources constitutes a large repository. After they are transferred into the relational database by manual loading or automatic information extraction, three-layer functionalities are developed and implemented to inform different groups: students, academic staff and decision-maker in a number of ways (Figure 1).

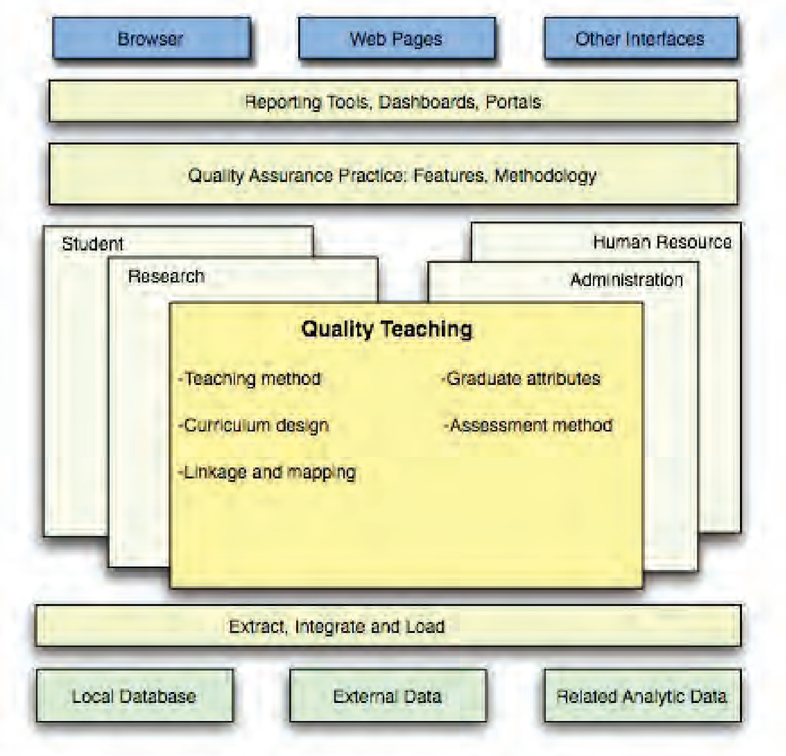


Figure 1: Application framework

Case study: Faculty of Engineering at the University of Sydney

Curriculum development workflow

The University of Sydney is a large, research-focused and multi-disciplinary university. In the past few years, the administration that specifies policies conditioning teaching and learning activities has proposed new policies and procedures for quality assurance. They include a performance-based funding model for teaching and learning, faculty teaching and learning plans and Academic Board reviews of faculties' teaching, learning and research training (Barrie & Prosser, 2003).

The Faculty of Engineering has four schools: Aerospace, Mechanical and Mechatronic Engineering (AMME), Civil Engineering (CE), Chemical and Biomolecular Engineering (CBE) and Electrical and Information Engineering (EIE). Each school provides several streams or courses leading to specialisations in a specific engineering field. There are approximately 300 units of study taught by the faculty including core, recommended and elective units. The unit of study design and quality assurance follows the workflow shown in Figure 2. First, the stream coordinator inputs the unit of study administrative information, including the unit coordinator, sessions, prerequisite, assumed knowledge and so on. Second, the unit coordinator is reviews the unit of study outline and supplies detailed information for teaching and learning arrangements, graduate attributes, assessment and curriculum design. Third, when the outline is finished, it is submitted to the stream coordinator. The stream examines it and provides suggestions or comments and, if satisfied, approves and publishes it, otherwise may request changes to the coordinator. The specific unit of study will only be visible to the students when closed and approved by the stream coordinator. The aim of this workflow is to guarantee the good quality of the descriptions, and to provide a central repository from which others can obtain information about the curricula. On the top of Figure 2 we show how the information can be used by the academic managers (decision-makers) to gain insight of the current teaching and learning practices. The system allows for institutions to adapt this workflow to their needs.

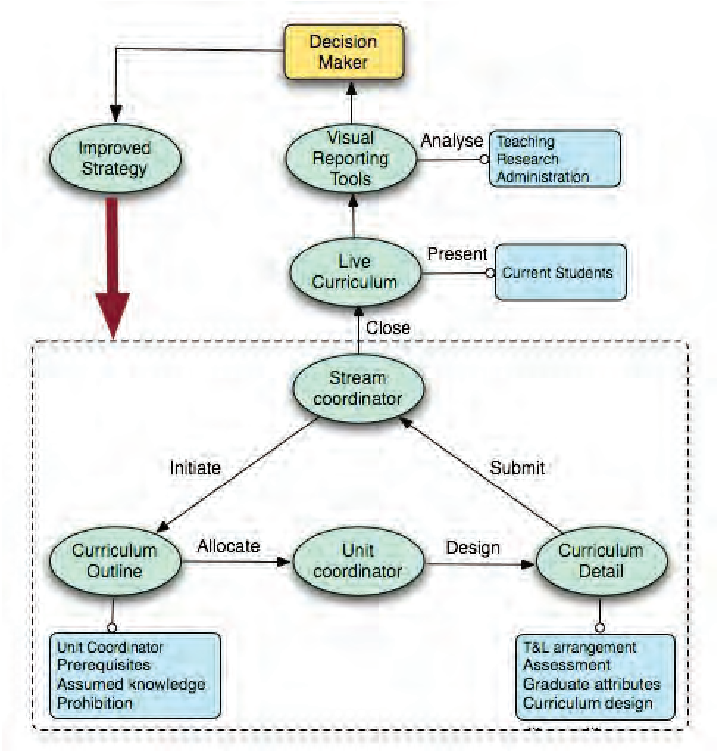


Figure 2: Curriculum inspection workflow

From the students' view, they can explore the graphical representations that display information about the specific course structure, the detailed syllabus of a particular unit of study including credit points allocated, objective, assumed knowledge, assessment methods and so on. This information is available through all the semester as the reference of the learning process and encourages students to be engaged in the learning experience. Figure 3 shows a screenshot of the unit map that gives students a picture of the course structure by listing all the units of study according to the different year and semester. Figure 4 shows a unit of study outline as seen by students.

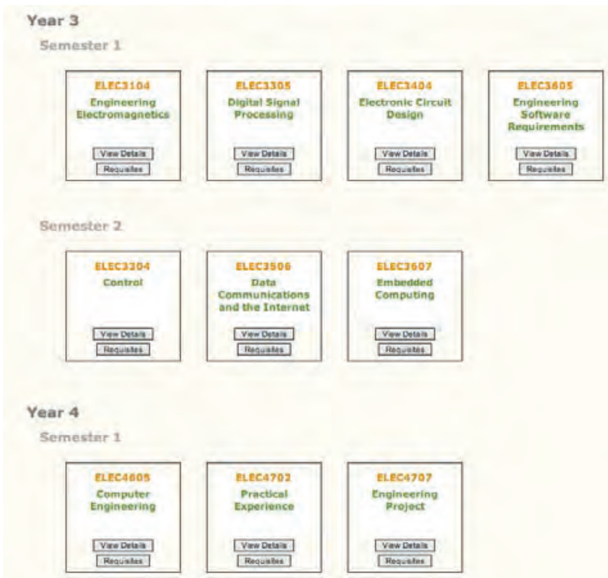
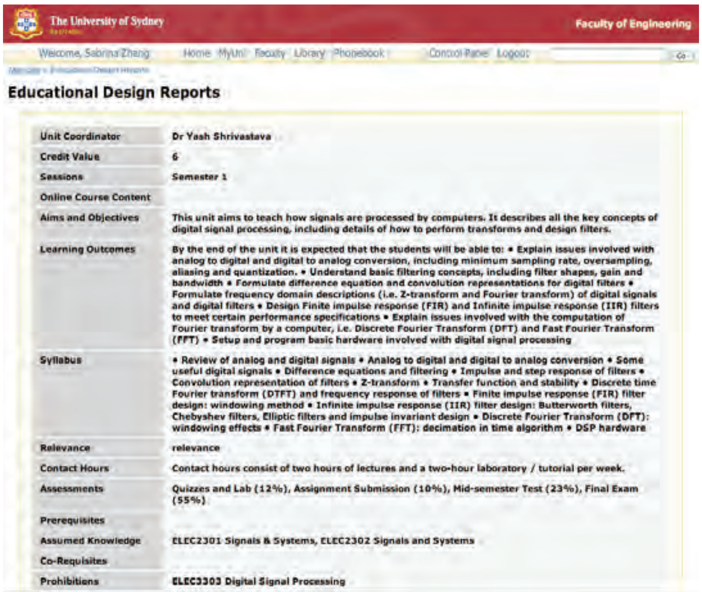


Figure 3: Course structure



The University of Sydney

Faculty of Engineering

Educational Design Reports

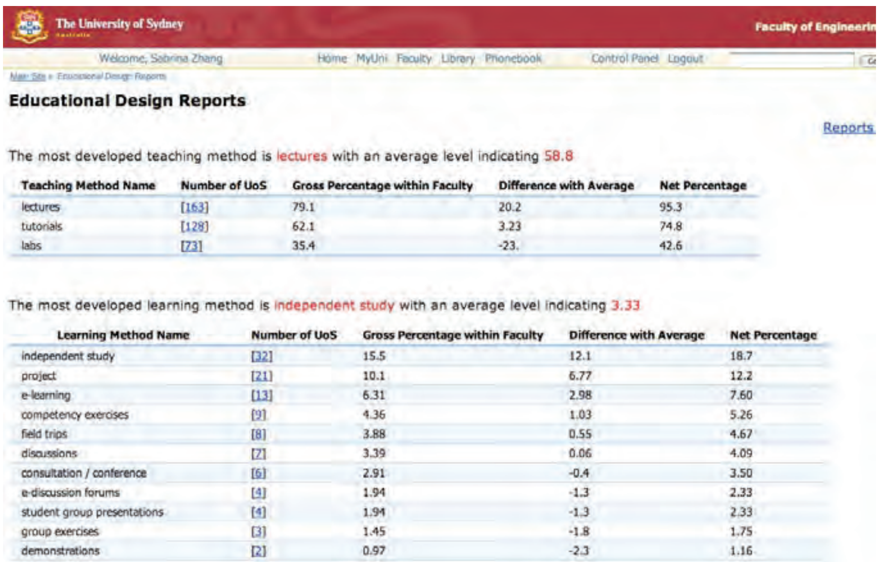
Unit Coordinator	Dr Yash Shrivastava
Credit Value	6
Sessions	Semester 1
Online Course Content	
Aims and Objectives	This unit aims to teach how signals are processed by computers. It describes all the key concepts of digital signal processing, including details of how to perform transforms and design filters.
Learning Outcomes	By the end of the unit it is expected that the students will be able to: • Explain issues involved with analog to digital and digital to analog conversion, including minimum sampling rate, oversampling, aliasing and quantization. • Understand basic filtering concepts, including filter shapes, gain and bandwidth • Formulate difference equation and convolution representations for digital filters • Formulate frequency domain descriptions (i.e. Z-transform and Fourier transform) of digital signals and digital filters • Design Finite impulse response (FIR) and Infinite impulse response (IIR) filters to meet certain performance specifications • Explain issues involved with the computation of Fourier transform by a computer, i.e. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) • Setup and program basic hardware involved with digital signal processing
Syllabus	• Review of analog and digital signals • Analog to digital and digital to analog conversion • Some useful digital signals • Difference equations and filtering • Impulse and step response of filters • Convolution representation of filters • Z-transform • Transfer function and stability • Discrete time Fourier transform (DTFT) and frequency response of filters • Finite impulse response (FIR) filter design: windowing method • Infinite impulse response (IIR) filter design: Butterworth filters, Chebyshev filters, Elliptic filters and impulse invariant design • Discrete Fourier Transform (DFT): windowing effects • Fast Fourier Transform (FFT): decimation in time algorithm • DSP hardware
Relevance	relevance
Contact Hours	Contact hours consist of two hours of lectures and a two-hour laboratory / tutorial per week.
Assessments	Quizzes and Lab (12%), Assignment Submission (10%), Mid-semester Test (23%), Final Exam (55%)
Prerequisites	
Assumed Knowledge	ELEC2301 Signals & Systems, ELEC2302 Signals and Systems
Co-Requisites	
Prohibitions	ELEC3303 Digital Signal Processing

Figure 4: UoS outline

Results

Not all unit coordinators filled all the information required despite being required by the administration. Academics expressed multiple reasons, from the lack of time to lack of understanding on how to do it. We produced two sets of statistical values: 'net percentages' that do not count units that did not respond to the particular item, and 'gross percentages' that count all units in the academic unit.

In the data collected for our faculty, we found that lectures (used in 79.1% of all the units and 95.3% of the units with data), tutorials (62.1% and 74.8%) and labs (35.4% and 42.6%) are the most popular teaching methods within the faculty (Figure 5). The different percentage for the same teaching method indicates the extent to which the relative information is stored in the system. The column 'difference with average' highlights outliers by showing the difference with the faculty average. In terms of the learning approaches, independent study (15.5%) is the most mentioned by academics, followed by projects (10.1%) and e-learning (6.3%). Most academics prefer to apply two or three teaching methods together rather than one which result in the diversity of the learning approaches and student experience.



The University of Sydney

Faculty of Engineerin

Educational Design Reports

Reports

The most developed teaching method is lectures with an average level indicating 58.8

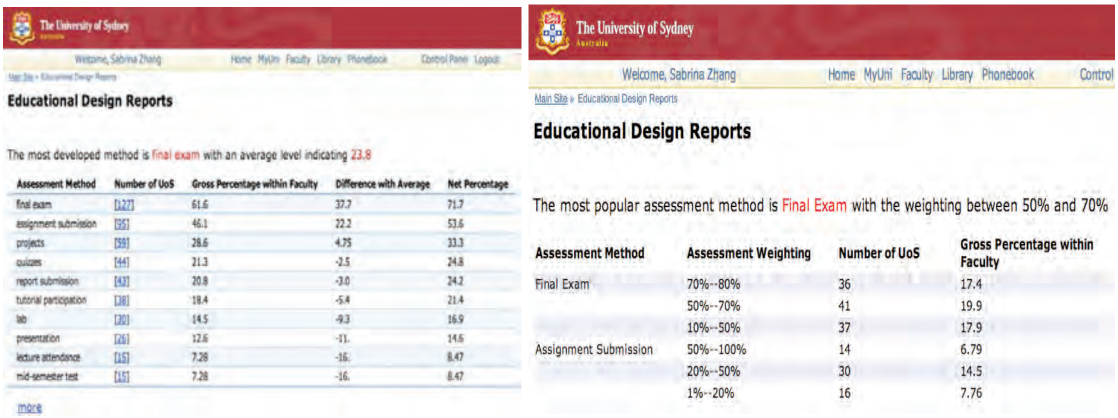
Teaching Method Name	Number of UoS	Gross Percentage within Faculty	Difference with Average	Net Percentage
lectures	[163]	79.1	20.2	95.3
tutorials	[128]	62.1	3.23	74.8
labs	[73]	35.4	-23.	42.6

The most developed learning method is independent study with an average level indicating 3.33

Learning Method Name	Number of UoS	Gross Percentage within Faculty	Difference with Average	Net Percentage
independent study	[32]	15.5	12.1	18.7
project	[21]	10.1	6.77	12.2
e-learning	[13]	6.31	2.98	7.60
competency exercises	[9]	4.36	1.03	5.26
field trips	[8]	3.88	0.55	4.67
discussions	[7]	3.39	0.06	4.09
consultation / conference	[6]	2.91	-0.4	3.50
e-discussion forums	[4]	1.94	-1.3	2.33
student group presentations	[4]	1.94	-1.3	2.33
group exercises	[3]	1.45	-1.8	1.75
demonstrations	[2]	0.97	-2.3	1.16

Figure 5: Teaching and learning methods analysis

With respect to the assessment, Figure 6 shows that final examinations account for the largest percentage (61.6% and 71.7%) followed by the assignment submission (46.1% and 53.6%) and projects (28.6% and 33.3%). Although educational researchers agree that novel assessment methods should be used besides the final examination, the examination is still the most weighted method. This analysis can be used to learn about assessment strategies that are being used and maybe support academics who take innovative approaches. The combination of various methods leading to the proper evaluation will be an important aspect in coping with the curriculum development. We also provide an analysis in the individual department and the results indicate that different methods deployment occurs in the different school.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Educational Design Reports

The most developed method is final exam with an average level indicating 23.8

Assessment Method	Number of UoS	Gross Percentage within Faculty	Difference with Average	Net Percentage
final exam	[127]	61.6	37.7	71.7
assignment submission	[95]	46.1	22.2	53.6
projects	[59]	28.6	4.75	33.3
quizzes	[44]	21.3	-2.5	24.8
report submission	[43]	20.8	-3.0	24.2
tutorial participation	[38]	18.4	-5.4	21.4
lab	[30]	14.5	-9.3	16.9
presentation	[26]	12.6	-11.	14.6
lecture attendance	[15]	7.28	-16.	8.47
mid-semester test	[15]	7.28	-16.	8.47

more

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Main Site » Educational Design Reports

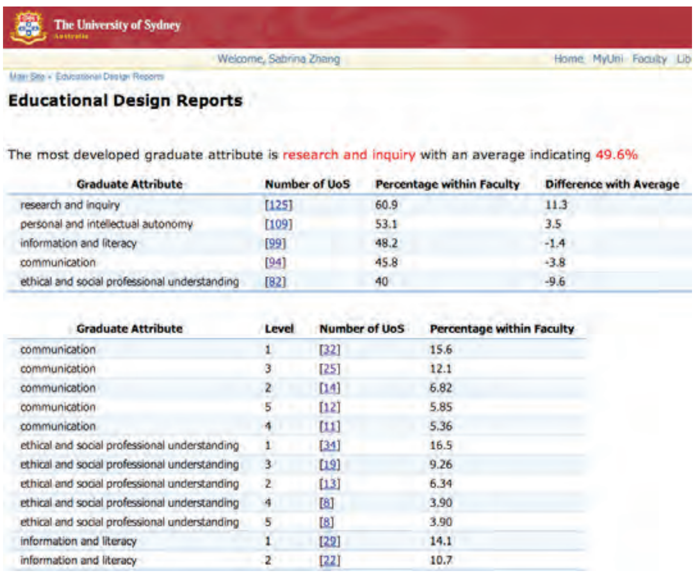
Educational Design Reports

The most popular assessment method is Final Exam with the weighting between 50% and 70%

Assessment Method	Assessment Weighting	Number of UoS	Gross Percentage within Faculty
Final Exam	70%--80%	36	17.4
	50%--70%	41	19.9
	10%--50%	37	17.9
Assignment Submission	50%--100%	14	6.79
	20%--50%	30	14.5
	1%--20%	16	7.76

Figure 6: Assessment methods analysis

The analysis of the development of graduate attributes showed that they have been widely considered in the design of the curriculum and more than half of the entire units of study intend to develop over three kinds of graduate attributes (Figure 7). Among the five graduate attributes officially designed for our faculty, the attribute of ‘research and inquiry’ is the most popular one, followed by ‘personal and intellectual autonomy’, ‘information and literacy’, ‘communication’ and finally ‘ethical and social professional understanding’. Students are predicted to develop various skills and meet the industry requirements after graduation so more and more academics tend to pay attention to the graduate attribute development which can be shown from the evidence of the reports. Academics assign levels in the 1 to 5 range, according to how much emphasis to place on each attribute. Communication skills have the lowest level in more than thirty percent of the units of study, and only a small number of units of study are designed to develop the high-level communication skills. The analysis of the graduate attributes provides evidence that might help in the improvement of the curriculum design.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Educational Design Reports

The most developed graduate attribute is research and inquiry with an average indicating 49.6%

Graduate Attribute	Number of UoS	Percentage within Faculty	Difference with Average
research and inquiry	[125]	60.9	11.3
personal and intellectual autonomy	[109]	53.1	3.5
information and literacy	[99]	48.2	-1.4
communication	[94]	45.8	-3.8
ethical and social professional understanding	[82]	40	-9.6

Graduate Attribute	Level	Number of UoS	Percentage within Faculty
communication	1	[32]	15.6
communication	3	[25]	12.1
communication	2	[14]	6.82
communication	5	[12]	5.85
communication	4	[11]	5.36
ethical and social professional understanding	1	[34]	16.5
ethical and social professional understanding	3	[19]	9.26
ethical and social professional understanding	2	[13]	6.34
ethical and social professional understanding	4	[8]	3.90
ethical and social professional understanding	5	[8]	3.90
information and literacy	1	[29]	14.1
information and literacy	2	[22]	10.7

Figure 7: Graduate attributes analysis

Regarding the curriculum content, the weekly schedule informs us the workload allocation and assessment in each week during the semester. The appropriate workload allocation in each week contributes much to enhance students understanding of the new knowledge and otherwise the overloaded or insufficient homework will have a negative influence on students learning process. In addition, the comprehensive analysis of all enrolled units of study for the individual student is explored to makes us aware of the student's workload and propose more reasonable guidance for the enrolment of the offered units of study.

The statistical reports provided can also be used to compare common educational design approaches between institutions. In a separate project we are producing a collection of educational design descriptions from Open Courseware initiatives such as the one at the Massachusetts Institute of Technology. The courses in these repositories contain a syllabus that tells us a lot about how the courses are taught. With the tool described here we will be able to statistically compare educational design approaches between institutions.

Conclusion

We have described a quantitative approach to supporting quality teaching practices based on a software application that collects and analyses educational design data. We have used the Faculty of Engineering at the University of Sydney as a case study of how the tool can be used. The key features of quality teaching we have used where the teaching methods, assessment, curriculum design and graduate attributes defined are considered as the backbone of the practical analysis in the engineering faculty. The research and administration activities closely associated with teaching are involved to constitute the big picture of the learning organizational infrastructure.

The tool was developed to provide statistical information for the decision-makers, academic staff and current students. The generated concept maps and visualisation tools help students have deep understanding of the course structure, syllabus and connections. The strict workflow for the development of the curriculum supports quality assurance of teaching and learning approaches within the faculty and provides an opportunity for academics to learn from each other's experiences, and to raise the practice of quality teaching. The results from a series of reports are proved to be the evidence of the improvement of the teaching and also figure out the key points the decision-makers need rethinking and developing further in the future.

We have not described the quality improvement process in which the data produced by this tool is used by the teachers to change individual syllabus, or the process used by academic managers to change degree structures or to take other administrative decisions. We have only mentioned that this is done by the learning and teaching and undergraduate committees. This is partially because the tools described here are still new and they still have to be integrated into the continued UoS improvement processes.
The tools give management information but the educational context in which they are used is much complex. In our faculty that context is one of continuous improvement primarily through promoting innovation and through the development of systems that embed innovative and improved practices, making them a sustainable norm.

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A lexical analysis of 1995, 2000 and 2005 ascilite conference papers

Craig Zimitat
Griffith Institute for Higher Education
Griffith University

Papers from the 1991, 2000 and 2005 ascilite conferences were analysed to identify key themes and concepts that have emerged from the thinking and research of Australian academics working with learning technologies. In 1995, themes were related to student learning and software / multimedia development. In 2000 there was a focus on student learning and specific products. In 2005, the online learning environment, learning activities and outcomes were key themes. Key themes in the whole collection of papers were the examination of most facets of "going online" and learning activities/assessment.

Keywords: lexical analysis, students, learning, learning technology, research themes

Introduction

The Australasian Society for Computers in Learning in Tertiary Education is getting close to the milestone of a quarter of a century of existence. During that time computers have shrunk from room size to pocket size, software has grown in complexity and educational paradigms have multiplied. The Society has held regular conferences since the early 1980s, and regularly published proceedings of those conferences. Since the mid 1990s, these conference proceedings have been made available on the internet as a searchable archive. This collection of documents is a useful resource for an examination of key themes and trends in the use of learning technologies in Australia over the last decade.

Content analysis can be considered as the "study of recorded human communications, such as books, web sites, paintings and laws" (Babbie, 2004). Descriptive content analysis involves the examination of large volumes of information, often using some theoretical framework as a scaffold for the identification of themes and concepts emerging from the data. The quality of the resultant analysis can be limited by inappropriate frameworks and lack of objectivity. Grounded theory approaches (Glaser & Strauss, 1967) involve being open to discovery of propositions; they do not test hypotheses. Through processes of note-taking, coding and memos, concepts and themes are sorted into categories and the 'theory' is emergent rather than a particular theory being imposed on the data.

Leximancer is a software tool used to support lexical-text analysis, consistent with grounded theory methodology. The body of text is examined and a ranked list of terms is generated by an analysis of frequency of use and related occurrence. These terms then feed into a thesaurus builder, which creates a set of classifiers by iteratively extending terms through identifying more distant co-occurrence. This results in the formation of *concepts* that are related to chunks of text, usually 2–3 sentences in length. Leximancer calculates the relative co-occurrence of concepts to generate a matrix which in turn is used to generate a visual display that illustrates the connectedness of concepts. Each concept is linked to the original reference text. This allows the user to revisit the analysis and impose specific limitations on the analysis, or seed the analysis with key terms or concepts. The advantage of using Leximancer, over hand coded descriptive or grounded theory analysis, is that large amounts of text can be subject to analysis in a routine manner, using consistent methodology that generates a repeatable outcome. Multi-dimensional visualisation techniques facilitate understanding of the relationships between concepts, as well as the strength of those relationships.

The purpose of this exploratory research was to (i) demonstrate the potential use of Leximancer to undertake lexical analysis of a limited amount of ascilite archival material, and (ii) through that analysis, identify key and emergent themes in a body of largely Australian research on learning technologies.

Method

Over 200 documents, refereed papers from ascilite conferences, were analysed to identify key concepts and themes that have emerged in the practice of academics using learning technologies over the last decade. Conference papers (full papers and short/concise papers) were downloaded from the ascilite website (www.ascilite.org.au) or Conference CD-ROM in the supplied file format. The abstract, figures, tables, list of references, acknowledgements, biographical notes and copyright statements were deleted from each paper and the documents were converted to text files for analysis. The list of authors and their affiliations were extracted from each file and saved by year. Similarly, lists of references from each paper were extracted from each file and saved in files by year of publication. References were checked for conversion failures and edited as necessary into a useable format. These lists were analysed to identify the most frequently cited journals and authors for each year.

Lexical analysis was undertaken using Leximancer v. 2.1 (www.Leximancer.com). Some details on the approach to using Leximancer can be found in Watson, Smith and Watter (2005). The default settings were used for analysis, with the following changes: (i) analysis blocks were set at two sentences; (ii) bigram sensitivity was set at 3 to treat hyphenated words as a single entity; (iii) language testing was turned off to exclude tables and lists from analysis; (iv) boilerplate was inactivated to exclude commonly used or ‘templated’ blocks of text; and (v) the learning threshold was set at default (10). These settings were preserved in the initial lex.config.pm file and were used for all subsequent analyses. The concept dictionary arising from the analyses was edited using the following processes: words and their plural forms were combined, words with their related tenses were combined, identical words in capitalised and non-capitalised forms were combined, and words with English and American spellings were combined. Abbreviations were combined with their long hand term, and special terms such as www, edu and au were deleted from the list of concepts. Other terms such as students and learners were not combined because of their potential to relate to other terms in different ways.

Results and discussion

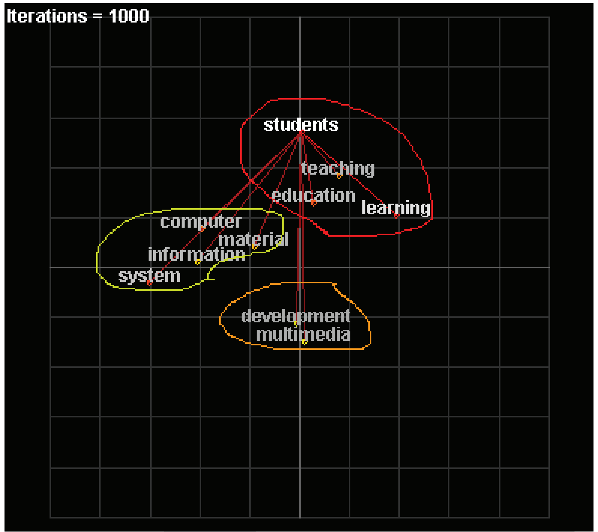
The spatial map and list of concepts for the analyses of the 1995 (*n*=65), 2000 (*n*=61) and 2005 (*n*=85) papers are showing in Figure 1. The spatial map illustrates three important characteristics of the text. First, the frequency of concept in the document collection is related to the boldness of the text – the bolder (or brighter) the concept, the more often it appears in the text. The brightness of the links between concepts reflects the co-occurrence of those concepts. Finally, the proximity between concepts in the map reflects their closeness in terms of appearing in related conceptual contexts within in the original text. The list of concepts is ranked, showing the top 10 or so concepts based upon frequency.

The primary ranked concepts in 1995 were students and learning. As illustrated in the spatial map, there were three clustered concepts in the 1995 papers – student learning, multimedia development and computer-based information and materials. This was a period of time bridging the CAL movement and Internet. The relative frequency of the use of terms online and internet was less then 5%, growing to 9% in 2000. The most frequently used terms in 2000 were students and learning, followed by internet, online and teaching. Three main themes in the 2000 papers included students learning online; the development of teaching and learning materials, and learning outcomes e.g. knowledge and development of skills.

In 2005, the most frequently used terms were learning, online and technology, and teaching and development. Themes emergent from the lexical analysis were: the online learning environment; social dimensions of online experience; and learning outcomes (skills, knowledge, assessment and feedback). Within the online learning environment theme were issues of access, support, academic staff development and the student experience.

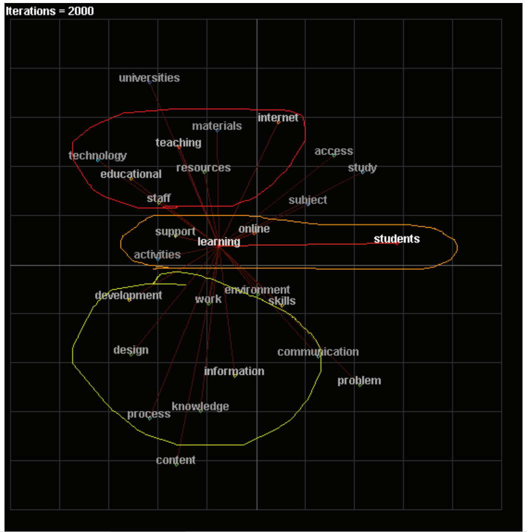
Overall, across the 204 full papers spanning the decade 1995–2005, the most frequently used terms were: development, online, teaching and technology. The three broad themes in the papers include: going online (the work involved in online teaching and teaching with technology); products (materials, information and resources), engagement and learning outcomes (including learning activities, design for learning and assessment).

ascilite 1995



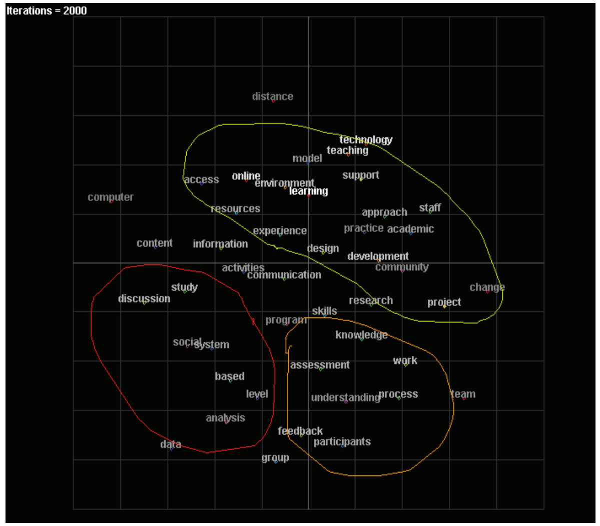
Concept	Rel Count
students	100%
learning	54.7%
system	32.9%
computer	26.6%
education	26.3%
information	24.6%
problem	24.3%
material	23.6%
teaching	23.3%
time	22%
program	18.9%
multimedia	18.7%
development	18.5%
technology	18.1%

ascilite 2000



Concept	Rel Count
students	100%
learning	48.2%
internet	20%
teaching	18.9%
online	17.2%
information	17.2%
educational	15.8%
problem	15.7%
development	14.5%
time	14.2%
skills	13.8%
support	12.6%
design	12.4%
content	12.2%

ascilite 2005



Concept	Rel Count
learning	100%
technology	52.3%
online	51.1%
teaching	36.2%
development	28%
environment	24%
project	21.7%
discussion	19.6%
support	19.6%
work	19.1%
feedback	19.1%

Figure 1: Lexical analysis of papers from each of the 1995, 2000 and 2005 ascilite conferences

Concept	Absolute Count	Relative Count
technology	2163	100%
work	1559	72%
online	1527	70.5%
development	1508	69.7%
teaching	1480	68.4%
information	1216	56.2%
system	1108	51.2%
staff	1065	49.2%
problem	1056	48.8%
design	981	45.3%
support	950	43.9%
education	947	43.7%
project	946	43.7%
process	921	42.5%
knowledge	849	39.2%
skills	845	39%
study	833	38.5%
educational	755	34.9%
research	729	33.7%
resources	719	33.2%
approach	718	33.1%
content	717	33.1%
university	711	32.8%
assessment	710	32.8%
communication	705	32.5%
access	685	31.6%
discussion	674	31.1%
experience	663	30.6%
computer	648	29.9%
feedback	577	26.6%
activities	558	25.7%
materials	546	25.2%
model	539	24.9%
program	538	24.8%
questions	537	24.8%
level	515	23.8%
learners	503	23.2%
evaluation	500	23.1%
delivery	482	22.2%
software	480	22.1%
multimedia	459	21.2%
analysis	451	20.8%
subject	451	20.8%
teacher	409	18.9%

Figure 2: The ranked concept list for all papers 1995, 2000 and 2005

Further work

This exercise has demonstrated the capability of the Leximancer software to analyse archival conference papers. A fuller and larger analysis of the whole of the ascilite archives, including all conference papers, concise papers and historical papers not on the internet, and other higher education teaching-learning and information and communications technology (ICT) conferences would be a useful exercise.
In tandem with this, an examination of the key reference sources used for these papers would yield further information on important conceptual and philosophical influences on writing, key monographs and key journals informing thinking, activity and research.

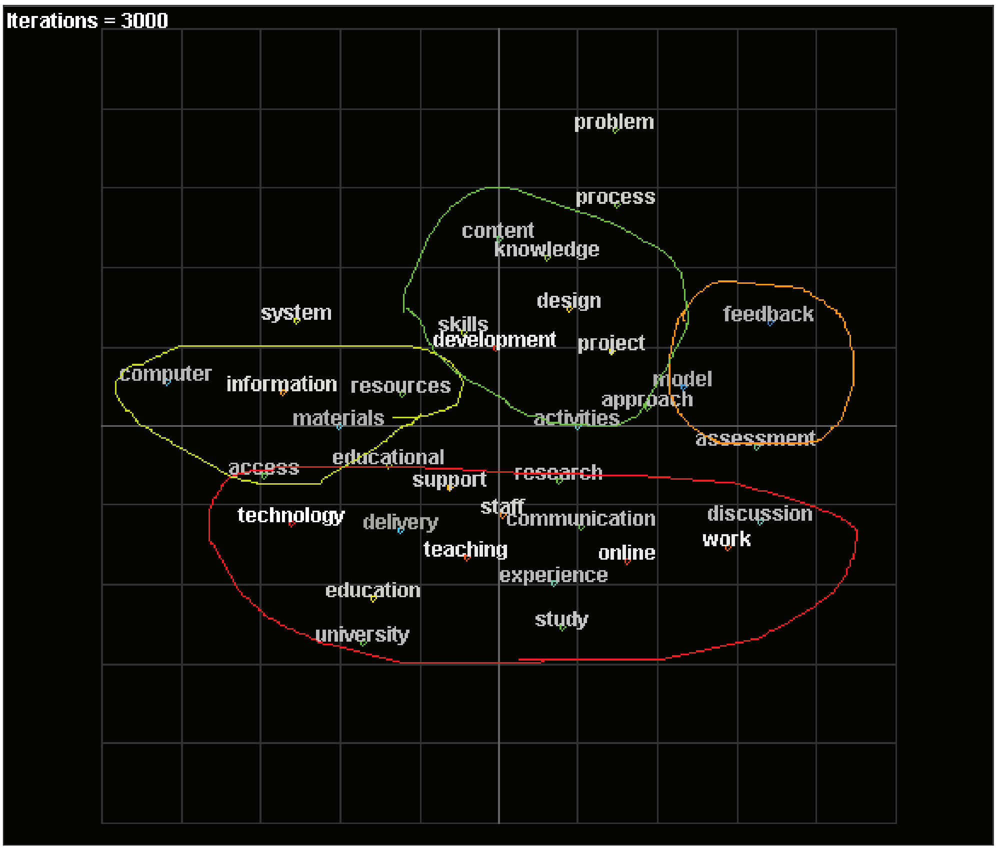


Figure 3: Lexical analysis of all 1995, 2000 and 2005 conference papers as one data set

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Appendix

Selected Conference Materials

Keynote presentation

Orchestrating integrated learning scenarios

Pierre Dillenbourg
Swiss Federal Institute of Technology, Switzerland

Higher education institutions have mostly experimented with two approaches to eLearning: distance and blended. Blended learning refers to the juxtaposition of face-to-face and computer-mediated activities, while distance education only includes the latter. The approaches that consider e-learning environments as stand-alone products failed to have a strong impact on pedagogical practices in higher education. Meanwhile, researchers have developed scenarios for integrated learning. We define integrated learning by reference to four characteristics.

Integrated learning refers to the organic interleaving of computerized activities (e.g. simulations, forums, exercises) with the diverse activities that occur in 'on-campus' courses (e.g. lectures, exercises, practical work, or even field trips). These activities are integrated from a pedagogical viewpoint, as they constitute a consistent scenario or script. They are also integrated from a computational viewpoint as they are related by some kind of workflow environment (e.g. results of teamwork with the simulation are synthesized for a subsequent class-wide argumentation seminar).

A scenario includes multiple activities, occurring at various social levels: individual activities (e.g. reading, writing summary), group activities (solving problems with a peer; conducting a project with other students, …) and class-wide activities (lecturing, debriefing, discussion, …). For too long, learning technology research has opposed the individualistic focus of instructional engineering with the social focus of computer-supported collaborative learning (CSCL). Integrated learning sidesteps this dichotomy and combines any activity form that is relevant for the learning objectives.

In these scenarios, the teacher is not in the background, as in many eLearning environments. Instead the teacher is the conductor: he/she orchestrates the sequence of activities and may change the scenario in real time. If it is true that technical constraints reduce the teacher's freedom to adapt his or her plan on the fly, we have to change the technology… not the teacher's freedom.

These scenarios do not occur in a virtual world ('virtual learning environment', ' virtual campus',…) but in specific physical spaces (classroom, labs, field, home,…). Integrated learning addresses the relationship between learning activities and their physical environment, for instance by using mobile technologies (e.g. location-based applications) or embedding technologies into furniture, buildings or artefacts. Computer science has shifted towards more physical kinds of interaction, through concepts such as 'tangibles', 'the disappearing computing', 'ubiquitous computing', 'wearables' or 'roomware'. The affordances of these emergent technologies for educational goals are still being discovered.

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Keynote presentation

Assessing who is learning and how

J. Michael Spector
Learning Systems Institute
Florida State University

Most would agree that it is important to assess the progress of learners so as to help learners identify areas in which they might focus attention and to help instructors and designers identify areas in which they might consider refinements in future offerings. Likewise, most would probably agree that within the educational technology community there has been a trend to use new and innovative technologies to support ever more complex learning situations. Assessing the progress of learning with regard to simpler learning tasks using well established technologies is a problem that is well understood. However, when learning involves complex and ill-structured problem solving tasks (e.g., crisis management, environmental planning, engineering design, medical diagnosis, etc.) and when powerful technologies are available to support learning, it becomes a significant challenge to determine how individual learners are doing and whether particular instructional approaches, strategies and technologies are effective.

In this presentation, an assessment methodology relevant to this problem will be presented and discussed. The methodology is based on the notion that how an individual thinks about representative ill-structured problems will reflect relative levels of comprehension and competency. Annotated causal influence diagrams are used to capture problem conceptualizations and used to indicate progressive development of understanding based on previous conceptualizations and those of highly experienced problem solvers. A Web-based tool will be demonstrated along with preliminary results of using this methodology and the tool.

Bionotes

J. Michael Spector is Associate Director, Learning Systems Institute, and Professor, Instructional Systems, at Florida State University. He serves on the International Board of Standards for Training, Performance and Instruction (ibstpi) as Executive Vice President, and is Editor of ETR&D-Development.

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Special session

eLearning for campus-based universities: Engaging the executive

Rob Ellis, session chair
The University of Sydney

Shirley Alexander
University of Technology, Sydney

Eddie Gulc
Higher Education Academy, England

Sandra Wills
University of Wollongong

eLearning advocates in campus-based universities in Britain and in Australia are having difficulty helping senior budget holders and strategic planners articulate a vision for eLearning in a campus-based experience. Too often sensible plans for embedding eLearning support and infrastructure in the learning and teaching systems of campus-based universities are put to one side because there is insufficient confidence by the executive of being able to justify why such investment is needed.

This can be as simple a problem as being unable to talk about eLearning and its contribution to the whole student learning experience convincingly for non-specialists. Further adding to such confusion is the fact that academics at the executive level may still hold old conceptions of eLearning being predominately about distant learning and can not envision why or how eLearning should be part of the reputation of a predominately campus-based institution.

This special discussion session at ascilite 2006 will discuss the nature of this phenomenon and strategies for how to begin to talk about and plan for integrated eLearning experiences in which eLearning is part of a more meaningful whole. Ideas and understandings that help non-specialists in the executive will be sought in discussion with the audience and the panelists. The experience of British universities engaging in an international benchmarking program and the experience of Australian universities grappling with these problems will provide a substantial framework in which to discuss the issues.

The panellists have significant and diverse experience:

- The chair, Associate Professor Rob Ellis, is Director of eLearning at the University of Sydney.
- Professor Shirley Alexander is about to take up a position as Deputy Vice-Chancellor (Teaching, Learning and Equity) at the University of Technology.
- Eddie Gulc is Senior Advisor for eLearning in the Higher Education Academy in England.
- Professor Sandra Wills is Director of CEDIR at the University of Wollongong.

Special session

ascilite and the Carrick Resource Identification Network project

Geraldine Lefoe, Meg O'Reilly
Executive members
ascilite, Australasian Society for Computers in Learning in Tertiary Education

Jenny Millea
Education.au

ascilite, in partnership with education.au and ACODE, have completed a preliminary investigation for this project with The Carrick Institute of Learning and Teaching in Higher Education. This session will provide an overview of ascilite's contribution and will also explore education.au's models of use to engage higher education. We will call for expressions of interest from ascilite members to contribute to the next stage of the project.

Keywords: repository, resource identification network

Project title: An identification and evaluation of key success factors and issues in the use of Digital Repositories for enhancing teaching and learning in national and international settings

The initial focus of the ascilite involvement in this project was to develop a map of the current landscape of resource information networks available both nationally and internationally. This overview identified key players, key resources, key institutions and the key issues in relation to digital repositories. The landscape provided a perspective of what, when, who, how, and why digital repositories are becoming important as the higher education sector undergoes change.

This overview of current practice and identification of key players was presented to a think tank forum of leaders from key organisations to identify directions for the future. ascilite will play an integral role in Stage 2 of this project, which will be conducted over the next 2 years. The focus of the ascilite involvement will be to further explore and evaluate the key success factors and issues in the utilisation of resource information networks. In particular an evaluation will be conducted of the key issues and success factors for higher education in both national and international settings related to:

- user needs and contexts of use for resource information networks;
- the reuse of learning objects housed in resource information networks;
- quality assurance with particular emphasis on the peer review of resources housed in resource information networks;
- incentives and rewards for users to engage in resource information networks.

During this session education.au will present their initial models of use. In addition, ascilite members will be invited to give their input to these and to indicate their wish to be involved on consultative sub-groups in the second stage of this project. Sub-groups will be involved in the evaluation and assessment of the key issues and success factors for resource information networks and the subsequent generation of recommendations to inform the larger project.

Acknowledgements

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Stage 1 Team: Mike Keppell, Sue Bennett, Meg O'Reilly, Geraldine Lefoe, Dominique Parrish. Stage 2 team: Geraldine Lefoe, Meg O'Reilly, Dominique Parrish, Di Newton, Cathy Gunn, Mike Keppell.

Special session

Publishing your research in journals: 'Meet the editors'

Catherine McLoughlin, Roger Atkinson
Australasian Journal of Educational Technology

Gráinne Conole
Open University, ALT-J: Research in Learning Technology

John Hedberg
Macquarie University, Educational Media International

We will concentrate this special session upon the interests of authors who have reached, or will soon reach, this stage with a research project (Pannell, 2002):

> *You've posted in your paper*
> *To a journal of repute*
> *And you're hoping that the referees*
> *Won't send you down the chute*

You will meet the editors of three international journals publishing in educational technology and related areas:

- Professor Gráinne Conole, Open University, UK
  ALT-J: Research in Learning Technology
  http://www.tandf.co.uk/journals/titles/09687769.asp
- Professor John Hedberg, Macquarie University
  Educational Media International
  http://www.tandf.co.uk/journals/routledge/09523987.html
- Associate Professor Catherine McLoughlin and Dr Roger Atkinson
  Australasian Journal of Educational Technology
  http://www.ascilite.org.au/ajet/

To enable an interactive session with time for numerous questions and comments, it will be structured into three sections, each commencing with a 3-4 minute opening statement from each journal, followed by 10-15 minutes discussion:

1. Journal policies. What does this journal offer you as an author? Topics may include kinds of articles sought (empirical, review, 'long', 'short', etc), the journal's publishing strategy (open access versus commercial), copyright and self archiving policies, and its measures of publishing success (impact factor, search engine profile, numbers of subscribers, hit counts, etc);
2. Journal procedures. What do the editors do upon receiving a submission? Topics may include editorial screening, selection of reviewers, numbers of reviewers, advice to reviewers, turnaround times for the review process, confidentiality of the review process, routine checks for self plagiarism, role of search engines, etc;
3. Journal feedback to authors. What do editors do to help authors after the review process? Topics may include the commonest and most important features of feedback to authors (whether accepted or rejected), how editors take into account inter-reviewer differences, how editors try to improve an accepted paper, and how editors may help you to maximise your prospects for a successful resubmission to the same or another journal.

In this session we wish to project an encouraging and supportive view of the editorial role. Editors, and reviewers, are not there as all powerful, ruthless guardians of high academic rigour, putting down all authors except the lucky or highly ranked few. The more important role in relation to authors is as advocates, developers, coaches, even 'guides on the side'. Editors do have other roles that are also important to authors, so we will use a little time, in 'Journal policies', to discuss scholarly publishing as an industry and how societies, editors, libraries and the commercial world have responded to the ICT revolution.

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Symposium

Realities of reuse, migration and repurposing of elearning designs

Mary-Jane Mahony
University of Sydney

Successful dissemination of elearning designs and digital resources created to support them implies real use by others. Continuing discourse at institutional and national level on strategies for dissemination implies that observed reuse remains limited. To achieve this on a broad scale benefits must be greater than the efforts of meeting the challenges faced. The goals of this symposium are to:

- Bring together people who have either experienced a migration/ reuse/ repurpose and lived to tell the tale and reflect on the experience, and/or who have researched such lived experiences;
- Promote discussion about experiences, issues and recommendations for facilitating use in universities of existing elearning designs and the digital resources created to support them.

The realities, rather than the rhetoric, of dissemination, adaptation and use will be the focus of this symposium.

Keywords: reuse, repurposing, adaptation, migration, dissemination, elearning, role plays, staff development

Overview

Migration, reuse and repurposing are all terms used to describe circumstances in which learning designs and the digital resources to support them are originally created for one teaching and learning situation and then used with some form of adaptation in another. There is a widely held view that such use is beneficial and is to be encouraged and supported. The Carrick Institute for Learning and Teaching in Higher Education commissioned reviews of dissemination strategies and achievements early in its establishment (McKenzie et al 2005; Southall et al., 2005). Littlejohn and colleagues (2003) devoted considerable attention to the state of play and the issues arising. The realities of the lived experience of migration, adaptation and reuse, however, are not widely reported.

This symposium aims to make that 'lived experience' more visible. The symposium papers will inform discussion about the issues and strategies found in individual experiences, and the implications thereof for institutional policies and practices.

Symposium papers:

- Devonshire, E. Re-purposing an online role play activity: exploring the institutional and pedagogical challenges;
- Pizzica, J., Mahony, M.J. & Devonshire, E. Repurposing an online tutor training resource;
- Lloyd, K. & Butcher, M. Reusing learning designs: role play adaptations of the Mekong and Ha Long Bay e-Sim;
- Wills, S. & McDougall, A. Facilitating uptake of online role play: reuseability, learning objects and learning designs.

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Symposium

Intercultural e-learning: Experiences of research in a Sino-UK context

David McConnell
Lancaster University, U.K.

Gordon Joyes
University of Nottingham, U.K.

This Symposium presents some of the research of members of the eChina-UK programme. The programme is funded in the UK by the Higher Education Funding Council for England, and its purpose is to bring about cultural awareness and good pedagogic practice between teachers and higher education institutions in the UK and China. Collaboration between UK and China teachers and researchers is a key feature of the programme.

Keywords: e-learning, cultural awareness, inter-cultural e-learning, teachers' development.

Overview

One of the goals of the eChina-UK Programme as a whole is to develop understandings in both countries of cultural change and exchange in e-learning pedagogy. In Phase One of the project, higher education institutions in the UK and in China collaborated in the development of Masters level courses to be delivered to school teachers in China via e-learning technologies. Some of the outcomes of this Phase of the programme can be viewed at http://www.echinaprogramme.org/

In Phase Two of the programme, we are building on what we learned in Phase One about collaborative course development and intercultural pedagogic practice and exchange, and extending that in various ways.

The four papers that make up this Symposium present intercultural understandings from a variety of Sino-UK perspectives viz a case study analysis of the participatory design of an online course in tutor training; the application of activity theory to tutors perceptions of e-learning; an examination of collaboration for inter-cultural e-learning; and an examination of Chinese higher education teachers' conceptions of e-learning.

The purpose of the Symposium is to take the opportunity to discuss our work with conference delegates, and engage in explorations of the meaning of intercultural e-learning and pedagogy. We are also interested in discussing with participants issues relating to carrying out research in different cultural settings, and the problems (ethical and methodological) in doing this effectively. The examples here are from a Sino-UK perspective, but we imagine that conference delegates will be in a position to discuss other examples of intercultural e-learning in the Symposium, and we will run the Symposium in a way that allows that to happen, and in ways that actively engage participants.

The four papers are:

Collaboration for inter-cultural e-learning: a Sino-UK case study
Sheena Banks, School of Education, University of Sheffield, UK

An activity theory approach to the exploration of tutors' perceptions of effective online pedagogy
Gordon Joyes, School of Education, University of Nottingham, UK

Chinese Higher Education Teachers' Conceptions of e-Learning
David McConnell and Jianhua Zhao, Department of Educational Research, Lancaster University, UK

A Participatory Design Approach to the Development of Online Tutor Training Materials - A case study from China

Chen, Zehang, School of Foreign Languages and Literatures, Beijing Normal University, China

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Poster presentation

The Merlin Affair: Addressing students' needs in learning media law through the use of multimedia environments

Des Butler
Queensland University of Technology

Traditional teaching and learning in law follows a standard formula of a program of lectures supported by small group tutorials which examine scenario-type problems. It might be queried how well such an educational approach equates with legal practice in the real world and meets students' real needs. The information required to resolve the problem rarely if ever comes conveniently summarised in a half-page tutorial question but instead has to be actively derived from a variety of sources.

The Merlin Affair is a multi-media program that is an integral component of *Media Law*, a final- year elective in the undergraduate bachelor of laws degree at the QUT Law Faculty. The program comprises a series of modules which address different areas of media law focusing on the central theme of an unfolding news story (the fictional uncovering of a corrupt politician), including confidentiality, privacy, defamation, contempt, and vilification. The modules involve a problem based learning approach which requires students to collect information or resources in a realistic context, distinguish the material from the immaterial, organise and analyse the balance, and communicate a resolution of the problem. In this way *The Merlin Affair* is designed to address students' real needs by presenting a learning environment that more closely simulates legal practice.

Keywords: teaching and learning strategies, content orientated applications, personalised learning, law, media law

Bionotes

Des Butler has published 10 researched books and numerous articles in a variety of areas including media law and has been involved in projects utilising technology to enhance learning since 1990. He has received several awards for research and teaching. In 2005 he received the QUT Vice Chancellor's Award for Teaching Excellence and in 2006 a University Innovator's Award for the use of technology to enhance learning and teaching. In 2006 he was nominated for a national Carrick Institute Award for Teaching Excellence.

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Poster presentation

Understanding the impact of tablet PCs on student learning and academic teaching

Steve Clark, Lucy Taylor, Joanne Pickering, Andrew Wait
University of Sydney

During semester 2, 2005 and semester 1, 2006 three academics in the Faculty of Economics and Business at the University of Sydney were invited to trial the use of Tablet PCs to deliver their presentations in lectures. This paper presents a study of teaching with Tablet PCs, combining real-time handwritten annotation with prepared material on digital slides, and evaluates the likelihood of its adoption as a teaching tool among academics. We gathered feedback from students by using a survey and provided a discussion board where students could post comments. We conducted interviews with academics using questions based on Rogers (2003) study into the impact of innovation on teaching. The results of this study will be used to inform the future direction of Tablet PCs in the Faculty and contribute knowledge to the broader learning community on this teaching tool.

Keywords: tablet PCs, innovation

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Poster presentation

New activity centred technology challenges students of midwifery: An evaluation

Ingrid D'Souza, Maria Miller, Jeremy Gauder, Ian Kershaw
Australian Catholic University (ACU National)

The Fetal On line Electronic Teaching & Learning (F.O.E.T.A.L) is a learning module designed to facilitate learning of Electronic Fetal Monitoring (EFM). The target audience incorporates students of midwifery at ACU National (Vic). Traditionally, the theoretical content was delivered face-to-face and the concepts were difficult to master in the time allocated. Therefore the decision was made to use WebCT as the learning platform and by doing so allowed the students to understand the concepts at a self-directed pace, revisit materials and practice interpretations of fetal heart rate patterns in a non-clinical practice environment.

Evaluation of F.O.E.T.A.L was conducted at the end of first semester 2006 utilising a variety of data sources: online student evaluation surveys, comments posted to the discussion area and achievements of related content in learning assessments. The focus of the evaluation was twofold: to assess the acquisition of knowledge and to beta test the F.O.E.TA.L program. One hundred and twelve students undertook the module and 46 completed the survey.

The e-learning delivery of EFM content to these students was evaluated as being effective in enhancing knowledge and understanding. In addition, students provided valuable feedback for ongoing development of F.O.E.TA.L. Students found that the content was extensive and that they had to spend a considerable amount of time undertaking the F.O.E.T.A.L module but it was considered as a valuable learning activity. They also commented that timely feedback was required and this could be enhanced.

Keywords: e-learning, midwifery, foetal monitoring, students, technology, WebCT

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Poster presentation

Developing online postgraduate coursework to promote change in animal industries

Hannah Forsyth, Chris Moran, Jaime Gongora
University of Sydney

Ruth Laxton
R. L. Learning Designs, Sydney

Julius van der Werf
University of New England

Educational theories are increasingly demonstrating the significance of a participative approach to educational design, development and teaching. This participative approach promotes the design of learning programs that consider learning on a larger scale than the individual – extending to transforming organisations, professions, industries.

This poster reports on an action research project attached to a new postgraduate coursework program in Animal Breeding Management. This online program is led by the need for animal industries to change practices in light of new knowledge and technologies in animal genetics and breeding.

Relevance to industry is not the only contributing factor in the project - university and government imperatives for efficiencies through collaboration mean that the project is being conducted collaboratively by the University of Sydney and the University of New England and is being managed and developed by a team consisting of academic specialists, an educational designer and a manager.

The poster shows how the various stakeholders are committed to a two-way learning process during the program development and outlines the collaborative effort between the two universities. Outcomes to date suggest that, to meet stakeholders' shared goal of change across animal industries, alignment of industry needs, academic validity, management and educational design is necessary.

Keywords: learning communities, collaborative learning, organisational change, educational paradigms, teaching and learning strategies

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Poster presentation

“I haven’t studied for twenty years and now I have to do it online”: Online orientation for postgraduate students in veterinary science

Hannah Forsyth, Meg Vost, Jenny-Ann Toribio, Sarah Graham, Karen Black
University of Sydney

Ruth Laxton
R. L. Learning Designs, Sydney

It is not a new thought that good induction and orientation in Higher Education, prepared in a targeted and supported way, enables improved student socialisation and retention (McNickle, 1999; Bozarth, 2004; Salmon, 2000). The challenges of providing this orientation increase in distance study and are particularly acute for students whose earlier experiences of study are pre-web.

The online orientation tutorial for postgraduate students in Veterinary Science aims to:

- Enable students to develop technological and information skills
- Provide clarity in the processes required for completing formal study by distance
- Equip students with core study and time management skills
- Encourage early adoption of reflective practice
- Prepare students for the challenges of online group work
- Provide opportunities for social and professional interaction online
- Reduce the stress of impending study

As well as these orientation-focused goals, online orientation has been designed to encourage students to adopt their *actions* in the online classroom to be the goal of their learning behaviour (cf Young, 2004), rather than considering the online classroom to be a web-based *information resource*, as previous experience with the web might imply. This prepares students to take an active and collaborative approach to learning.

Keywords: orientation to online learning, student orientation, preparation for collaborative online study, postgraduate coursework, orientation to distance education

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Poster presentation

Benchmarking e-learning: The UK experience

Eddie Gulc
The Higher Education Academy

The Higher Education Academy (The Academy) is leading a UK-wide higher education e-learning benchmarking exercise and is keen to work with the sector to describe and monitor the achievement of strategic goals in e-learning and support the development of benchmarking processes and tools. 12 institutions were selected to join the Pilot Phase in January 2006 and in October 2006 another 39 institutions joined Phase 1.

What is being benchmarked has been informed by the contexts and priorities of the participating institutions. The exercise has not been prescriptive about processes and tools at this stage so during the Pilot Phase the institutions selected five differing approaches to benchmarking - see Figure 1.

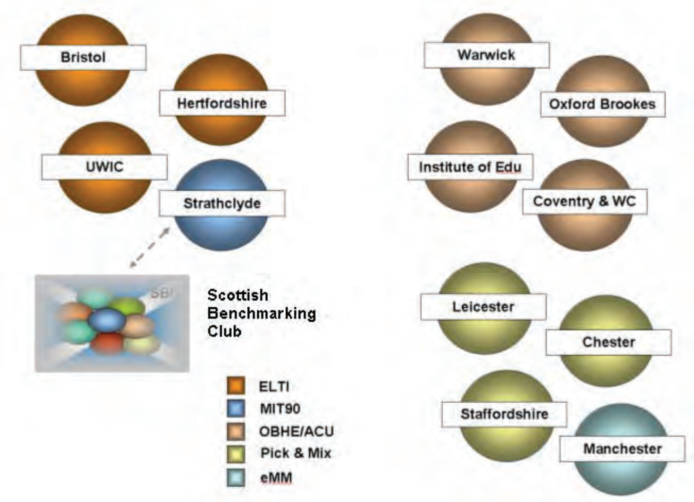

Figure 1: Overview - The e-benchmarking pilot

Some Issues in the Pilot Phase:

- To establish a common understanding, among participating institutions, about what is meant by e-learning, embedding, and benchmarking;
- Following on from this, if e-learning is embedded is it possible, easy, or desirable to try and isolate the exact contribution the 'e' made to the learning? If not, we end up not benchmarking e-learning at all, but something far broader;
- Deciding on the most meaningful organisational unit for benchmarking: is it at institutional, faculty, school level etc?;
- The extent to which the Academy should demonstrate leadership with regard to the direction of developing a diverse approach to benchmarking rather than 'champion' any single approach;
- To evaluate whether the 'constrained diversity' approach taken proved to be the correct one? The view taken was that a heterogeneous higher education sector requires some degree of heterogeneity of approach;
- The extent to which institutions have prioritised development over comparison?

Further information about the exercise can be found at:
http://www.heacademy.ac.uk/benchmarking.htm

Or from the benchmarking weblog at:
http://www.heacademy.ac.uk/weblogs/benchmarking/

Keywords: benchmarking, higher education, e-learning, organisational change

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Poster presentation

Reducing staff and student workload: Redevelopment of an online law unit

Kerryn Jackson, Bill Potter, David Lindsay, Len Webster, Kathy Buxton, Melissa deZwart
Monash University

Law of the Internet was the first entirely online postgraduate unit offered by the Faculty of Law at Monash University. It was first offered in 1999 and has been offered at least twice a year since that time. The unit was designed around a website presenting ten modules of content and four discussion forums. Online tasks were submitted via the discussion forum or via email, with student-teacher interaction facilitated via the discussion forums. The constantly changing nature of the unit content, the volume of tasks completed by the students and associated assessment, and the heavy administrative load have created a unit that is very labour intensive for both students and staff.

As the Faculty moves to the provision of increasing numbers of online postgraduate units, it was decided to revisit the design of Law of the Internet with a view to reducing the workload commitment of the teacher and support staff. This poster outlines the process of that review, the selection and implementation of alternative technologies, including wikis and an in-house collaborative learning environment, LEX. Preliminary results as to the impact of the redesign on staff and student workloads will be presented.

Keywords: online unit, collaborative learning, wiki, online assessment, LEX

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Poster presentation

I want to tell you a story…

Martin Jenkins, Kenny Lynch
University of Gloucestershire

This poster will report on developmental work on the use of both podcasting and digital storytelling as part of students' induction to higher education. These techniques are used to both provide information and context for students and as methods to record the student experience.

Students in the Department of Natural and Social Sciences are inducted into higher education using field based activities linked to learning development module. During the induction week new students are engaged in two days field work that introduces them to active learning, the dominant pedagogical philosophy of the Department. As part of the students' reflection and evaluation on these activities, working in small groups, they produce a digital story.

Podcasts are then used throughout the learning development module to provide context and additional information leading to students creating their own podcasts.

The evaluation has focused on assessing the students' perceptions of the value of these techniques to their learning experience, using questionnaire and focus groups. Academic staff views on developing these resources and their use have also been sought through questionnaire and interview.

Keywords: podcasting, digital storytelling, student induction

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Poster presentation

Investigating teachers authoring their own learning designs

Matthew Kearney, Anne Prescott, Kirsty Young
University of Technology, Sydney

The 'project in progress' is situated in pre-service education and investigates prospective teachers authoring and use of their own online learning designs. Secondary and primary pre-service teachers adopted exemplary, well-researched learning strategies to inform the design of their own specific online learning tasks. (Strategies included analogical reasoning; predict-observe-explain; and 'learners' questions' approach.) The teachers then used their online tasks in the context of their teaching practicum. The web-based *Learning Activity Management System* (LAMS) acted as a 'test-bed' and support for their designs and implementation. This poster will report on preliminary findings from the study, focusing on key issues relating to the student teachers' professional learning. Research questions addressed in this poster are: How does this authoring and implementation process help student teachers to 'build bridges' between theory and practice in their teaching degree? To what extent do they develop their knowledge of (online and face to face) teaching and learning? To what extent is their understanding of specific learning strategies enhanced?

Keywords: teacher education, learning designs, learning strategies

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Poster presentation

Learning to teach online *online*: Training remote facilitators in postgraduate veterinary science programs

Ruth Laxton
R. L. Learning Designs, Sydney

Hannah Forsyth, Jenny-Ann Toribio
University of Sydney

The Veterinary Public Health Management Program at the University of Sydney is an online postgraduate program, a small component of which is taught by staff, while the majority is taught by a range of industry experts who are located around Australia and internationally.

Our challenge was how best to train and induct these external facilitators in teaching online in the program – all within a limited budget and time constraints. Our solution is an online tutorial which gives the facilitators basic skills in online facilitation and an orientation to the program.

The online teaching tutorial focuses on:

- Developing core skills in using the learning software
- Characteristics of effective online learning activities
- Conducting valid and authentic assessment in an online environment
- Supporting and assessing collaborative learning approaches

Given our facilitators are practicing and busy experts with altruistic motivations for teaching, it was necessary to design the teaching tutorial with the flexibility to work through topics of interest at times that are convenient with information and activities chunked and pitched at different levels for facilitators with previous teaching experience and those without. Feedback and teacher performance has demonstrated the online teaching tutorial to be an effective method of training remote facilitators.

Keywords: online teaching, e-moderating, training external teachers, industry participants in teaching

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Poster presentation

The collaborative work between learning technologists and academics in implementing online learning

Yik Sheng Lee, Siaw Way Poh
Tunku Abdul Rahman College

A recent study on e-leaning readiness of at least 30 institutions of higher learning in Malaysia has provided a good overview of the status of online learning adoption in the country. It was noted in summary of the report that the enablers and receivers recorded the lowest level of readiness amongst the four groups (the other two being policy makers and providers) of personnel surveyed. It is vital to take a closer look at the factors and processes that affect the enablers and receivers in adopting online learning. This will inform policy makers on designing plans to promote a higher level of readiness. This concise paper is a preliminary report of an on-going action research. The focus of this research is the working practices of enablers such as learning technologist and academics. The research documents the actions of the learning technologist while working with academics to implement online learning. It takes a detail look at the factors that promote, inhibit and sustain a successful collaboration. It also studies the roles played by both parties and the possibilities of replicating the same practices campus wide. This paper will present the background, the research questions, the methods used and the initial findings of this study.

Keywords: online learning, higher education, collaboration, organisational change, action research

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Poster presentation

Semi-automated assessment and workload expectation mapping

Melinda Lewis, Mary Jane Mahony, Ann Poulos
University of Sydney

The Faculty of Health Sciences at the University of Sydney has conducted a mapping project to develop a deeper understanding of assessment factors which potentially impact on students' perception of workload. Electronic capture of annual faculty Assessment Program Meeting (APM) data, as well as lecturer's perceptions on preparation time, generated semi-automated assessment and workload expectation maps.

Data were imported into Excel spreadsheets. The initial data tables provided a preliminary picture of assessment and workload expectations. Charts of predicted student workload directly related to assessment tasks were produced. The assessment profile across a unit of study, a semester, a year and a program made visible:

- exam clusters
- several due dates for assignments coinciding
- where preparation time identified by lecturers was short and intense, or on-going and overlapping

Embracing informatics approaches to semi-automate assessment mapping can aid individual unit of study coordinators' efforts to manage the whole of student experience with regard to assessment times and workload. Profile construction aids identification of over redundancy of assessment method, gaps in student development opportunities, and workload periods which may lead students to surface rather than deep learning strategies.

Keywords: semi-automated assessment, higher education, workload, health sciences

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Poster presentation

Do we know what skills our students think are being tested in exams?

Jennifer Lingard, Laura Minasian-Batmanian, Ian Cathers, Mary-Jane Mahony, Gilbert Vella
University of Sydney

In a substantial assessment policy change, the University of Sydney is moving to grade allocation based on published standards, rather than cohort distribution. Examiners often allocate higher grades to students who exhibit higher level skills, as based on a taxonomy such as Bloom's (Krathwohl, 2002) or SOLO (Boulton-Lewis, 1998). However, many students do not understand exactly what skills are required in terms of gaining these higher grades. Questions thus arise as to whether or not students have the same perception of the grading system as those who set the assessment tasks and also if students with more accurately aligned perceptions perform at the higher levels. As students' learning behaviour is influenced by their perception of what skills are required to obtain higher marks (Trigwell & Prosser, 1991; Prosser, Trigwell, Hazel & Waterhouse, 2000), it is crucial to know what our students think is being tested.

This research aimed to find out if students performed better when their perception of the skills being tested in a particular exam question was well aligned with staff judgments. First year Physiotherapy students (160) undertook an optional online trial exam in their first semester biochemistry unit. This exam consisted of thirty multiple choice questions that were prepared and graded for skill requirement by three content and educational experts. Students indicated their perception of the skill level being tested by each question. Multiple attempts were permitted. Detailed feedback on content and skill testing was also provided online.

About 80% of students completed the assessment, and many have attempted it again. Preliminary data analysis indicates that students view the skills being tested in a much narrower band than do staff i.e. questions testing lower level skills are seen as being more difficult, and vice versa. It is intended to correlate student perceptions with several factors, including their prior level of topic knowledge and final exam performance.

Keywords: grade descriptions, student perceptions, assessment, student learning

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Poster presentation

Team Contribution Tracking System (TeCTra) for assessment of individual contributions in groupwork

Andrew Litchfield, Ryszard (Richard) Raban
University of Technology Sydney

The purpose of the poster is to present a self and peer assessment tool (**Te**am **C**ontribution **Tra**cking system – TeCTra) that has been used in a software development capstone project in 2004 and 2005. TeCTra allows peer assessment and review – both quantitative and qualitative comment – throughout the duration of the project and thus it can formatively and positively influence individual contributions and behaviours within the team. The tool also calculates summative peer assessment outcomes that guide the student's final mark and grade. The capacity for peer review facilitates diagnostic attributes and thus influences the project management process and outcomes. The poster will present key elements of the tool and results achieved through using it in self and peer assessment of individual contribution in groupwork.

Keywords: self-assessment, peer-assessment, assessment tools, collaborative learning

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Poster presentation

A French Master's degree in e-learning: Are the students' needs met?

Debra Marsh
Mauguio, France

Rachel Panckhurst
University of Montpellier 3

In 2004, a new 2-year Master's programme on "Knowledge Management, Learning and e-learning" in the Language Sciences department of the University of Montpellier 3 was devised. The first year of the programme is both on and off-campus, and the second year is entirely off-campus. Some students enter the second year directly from the first-year course while other students enter from other Universities (either based in France or abroad).

Two years down the track, after a full cycle completed by students, we were keen to check how well we know our learners and to what extent their true needs are met. A questionnaire was designed and issued to students, tutors and teachers involved in the programme. At an initial stage of the research, questionnaire results were examined and provided knowledge about the "typical" learner and indicated if and how their needs have been met so far in relation to the Master's programme as it is currently structured. At a second stage, current models for online teaching/learning (Salmon's five stage model, Salmon, 2000) are discussed and compared with the Master's programme. Suggestions are made on how the programme can be improved based on both learner profile/needs and current online teaching/learning trends.

Keywords: teaching and learning strategies, learning communities, collaborative learning, computer-mediated communication, educational paradigms

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Bionotes

Debra Marsh was Head of e-learning at the University of Hull, UK until July 2002 and project managed the development and implementation of Merlin, the University of Hull's own virtual learning environment. She now works as a freelance e-learning consultant and is based near Montpellier, France. She is currently working for the University of Cambridge, UK in a major eChina project. Her specific interest and expertise lies in the pedagogical issues raised when designing for and implementing e-learning.

Rachel Panckhurst is a maître de conférences (senior lecturer) in computational linguistics at the University of Montpellier 3, France. She was director of the University METICE centre for open, distance and virtual education (1999-2001). Her current research interests include computer-mediated communication and software evaluation for lifelong learning. She is co-author of an introductory book on information and communication technologies which was published in 2000, and she is co-editor of two books: one on autoevaluation and guided self-learning (2002) and the other on evaluation in e-learning (2004).

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Poster presentation

Interactions of students in online graduate courses

Joyce McCauley
Houston State University

Susan Wegmann
University of Central Florida

Catherine Stoicovy
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Mary Robbins
Sam Houston State University

Online learning is gaining in popularity with students and with university faculty worldwide. Most researchers agree that developing and nurturing communities within the online environment are critical elements in creating rich and empowering learning experiences. There is, however, little direction for developing a community of learners among a global student body. This poster describes one university's investigation of its online courses as it explores the participation of the graduate students in four types of interactions: (a) learner-content (the interaction between students and the course materials), (b) learner-teacher (the interaction between the students and the instructors), (c) learner-learner (the interaction between and among students), and (d) learner-interface (the interaction of the students with the online environment). A survey was created based on these four types of interactions and sent to previous and current graduate students. Preliminary results show positive responses in all four types of interactions. The surveys returned, however, were from Anglo-American students that comprise the majority of our graduate population. As our program expands to attract more students from outside of the United States, we will continue to administer the survey to monitor our focus on establishing rich interactions and rapport among and between students and teachers.

Keywords: online learning, higher education, collaborative learning, interaction

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Poster presentation

Podcasting and education: Time to start listening

Leon Newnham, Charlynn Miller
University of Ballarat

Universities are constantly challenged to seek methods to improve student engagement. Leading edge technologies such as podcasting may be one of the most effective ways to accomplish this engagement, particularly for those students aged between 18 and 25. Students within this general age group have been termed by many as Generation Y or the iLife generation. This is due to this group being attracted to new technologies, particularly Apple's iPod®. This attraction to multimedia based technologies may indicate that podcasting, an online multimedia delivery method, could become a valuable educational technology for Generation Y tertiary students.

This poster will present findings from a pilot study which aimed to measure student perceptions toward podcasting as a teaching and learning technique. Students of an introductory information system unit were provided with an educational podcast. This podcast included short discussions each week which would supplement lectures. The students in this unit were then surveyed to determine their perceptions of the technology, including whether they believe it enhanced their educational experience. Over 90% of enrolled students completed the survey, while over 90.2% of those respondents either agreed or strongly agreed that lecture material was easier to understand as a result of the podcast.

Keywords: podcasting, generation Y, iPod, iLife, technology, m-learning

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Poster presentation

Evaluation of genetics educational technologies used by science teachers

Amy Nisselle, Gregor Kennedy, Sylvia Metcalfe, MaryAnne Aitken
The University of Melbourne

The explosion of information and communication technologies has dramatically expanded the number of multimedia teaching and learning resources available. In addition, genetics is a rapidly-evolving subject that can be difficult to understand and requires up-to-date resources. Genetics educational technologies may be useful for teachers as the technologies may have the capacity to be updated and could overcome some difficulties in teaching and learning genetics. However it is not clear who the technologies should be tailored to – the teacher or the learner – and there is a lack of explicit guidelines relating to their use in the classroom. The first phase of this doctoral research project will determine what technologies are currently being used to teach genetics in Australian secondary schools. The second phase will comprise eight case studies of classroom practice, using the most popular technologies to evaluate: (i) how teachers incorporate technology into classroom learning environments; (ii) the degree to which popular resources accommodate a range of approaches to teaching and learning; and (iii) practical factors that enhance or diminish teachers' and learners' educational experiences in the classroom. From these evaluations guidelines will be produced for teachers, learners and the wider community on how to appropriately select and use genetics educational technologies.

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Poster presentation

There's more to it than instructional design: The role of individual characteristics in hypermedia learning

Maria Opfermann, Peter Gerjets
Knowledge Media Research Center

Hypermedia environments offer a high amount of learner control including the option to select and combine different representational codes and address different sensory modalities. Additionally, learners can access information in a linear as well as a nonlinear fashion. However, according to prior studies, it can be questioned whether learners are able and willing to appropriately use this navigational and representational freedom. Research suggests that the relationship between the design of hypermedia environments and learning strategies as well as outcomes is moderated by individual differences, i.e., learner characteristics. In our study, we investigate the role of epistemological beliefs, attitudes, and metacognition. Two questions are in our research focus: (1) Is their influence domain specific or general? and (2) Is there an optimal degree of learner control for learners differing on these dimensions? The study is being conducted using a learning environment on probability theory. First results show that learner characteristics come into play when a high amount of learner control is provided in that sophisticated beliefs and positive attitudes lead to longer learning times and higher performance. For metacognition, however, we found that low scoring leads to better performance. These partly surprising results will be presented and discussed in December.

Keywords: hypermedia, learner characteristics, epistemological beliefs, attitudes, metacognition

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Poster presentation

Bringing together accessibility research and enterprise activities

Elaine Pearson, Steve Green
University of Teesside

Universities are now expected to generate income through business activities as well as through increasing student numbers. One of the many challenges facing us in meeting this demand is how academics can apply their research expertise to income generation and at the same time feed back into their teaching activities. At the University of Teesside, (in collaboration with the University of Sunderland) one way we are tackling this challenge is through the Digital Knowledge Exchange(DKE), a project funded through the Higher Education Innovation Fund (HEIF). The DKE has been granted over £1M for its initial four years of operation.

The aim of the project is to bring together businesses, public bodies, charities and other organisations to support innovation and income generation activities. The rationale is that by providing access to specialist research groups and expertise, we can effect transfer of knowledge that enables business to realise new skills, facilitate joint research activities and support new initiatives.

DKE offers services that draw on the research expertise of the School of Computing, in accessibility, usability, web services, serious games and elearning. This poster will illustrate one particular aspect of this project – the interplay of research and enterprise in supporting accessible online practices.

Keywords: organisational change, partnership, higher education, accessible online practices

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Poster presentation

Pilot study to review use of WebCT in taught units

Lynnae Rankine, Janne Malfroy
University of Western Sydney

The University of Western Sydney has a high level of use of the e-learning system, WebCT, with more than 1100 staff and 33,000 students accessing more than 2,300 sites. Within the University, there was a perception that the e-learning system was largely used by staff to provide learning materials and resources to students. To investigate this further, a pilot study was set up to examine the range of flexible learning approaches used in WebCT across a sample of undergraduate and postgraduate sites.

The pilot study reviewed 100 of the 700 taught unit sites in WebCT from Spring Semester, 2005, and checked for types of usage in these sites. A framework was developed to examine the 100 sites and record the diversity of ways in which WebCT was being used. The framework focused on the key areas of Content, Communication, Assessment and Explicit Learner Support.

The results show that academics are using WebCT for a range of purposes, with a particularly specific focus on explicit learner support. These results have helped de-bunk the myth that academics are only using WebCT to put up content, such as lecture notes. The study has provided results that need to be examined in more detail and in a larger study.

Keywords: e-learning systems, higher education, learning materials, flexible learning approaches

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Poster presentation

Living English simulation learning for non-native English speakers

David Ross
University of Southern Queensland

Fiona McMullen
Lanstar Corporation

The poster presentation will be to show and illustrate an 'edutainment' computer learning methodology that creates an immersive learner simulation where users encounter various scenarios that occur in daily life requiring them to speak English. The simulation is modelled on the popular Sim City series. Learners will be able to move throughout a virtual learning environment interacting with different situations and program features whilst learning English. Decisions they make along with their current speaking abilities will then affect their progress through the simulation. The simulation can be offered as an online activity with other learners from around the globe or through a DVD for localized communication interactions.

The English speaking educational program already operates internationally providing English learning educational content to universities and companies. The computer simulation part of the total program is branching more into educational entertainment in Asian markets. Both The University of Southern Queensland (USQ) and Lanstar the corporate partner have track records in their fields and the simulation activity is one of several interactivities that complete the whole program. Features:

- A Karaoke Feature
- Games Simulation
- An Audio and Video record and playback feature
- Interactive Dictionary
- Lessons supported by several thousand exercises
- Artificial Intelligence
- Offered through a face to face e-learning and or DVD delivery methodology

Keywords: emerging technology, architecture and design, instructional design, personalized learning, teaching and learning strategies

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Poster presentation

Debating pain: A collaborative online group activity

Grace Tague, Liz Devonshire, Allan Molloy, Stephen Loftus, Philip Siddall
University of Sydney

This poster reports on an action research project investigating the development and implementation of an online debate activity in a core unit of study within the Graduate Studies in Pain Management Program. The activity required that students work in groups to debate the topic ‘pain is merely a symptom, not a disease’. It aimed to encourage critical engagement with a contemporary pain management issue, promote collaborative learning in an online context, and provide opportunities for reflection on the benefits and challenges of the group process. Learning design considerations included the: timing and focus of the activity in the curriculum; structure and sequencing of tasks; scaffolds and learning supports required; and student readiness. Initial findings highlighted the engaging and enjoyable nature of the task. Students reported the activity encouraged adoption of a more critical stance towards the course content and provided them with a valuable and worthwhile learning experience. They also commented that the cross-disciplinary discussion enriched learning and enabled new insights into the management of pain. From a teacher perspective the activity reinforced the importance of providing enough structure and appropriate learning supports to assist learners collaborate effectively in the online environment and achieve a specific group task.

Keywords: online learning, collaborative learning, online debate, pain management

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Poster presentation

What is ED?

Elizabeth Tuckerman
RMIT University

Our brief as members of central support groups was to re-develop the learning and teaching website for RMIT University. Our challenge was to provide a resource that educators would actually want to read, contribute to and enjoy. The result is ED, a unique resource that combines the conventions of a website with those of a magazine.

ED is characterised by its visual appeal and inclusiveness. It offers a different approach to discussion of learning and teaching than other university websites.

Keywords: instructional design, higher education, learning communities, online discussion

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Poster presentation

All the world's a stage: Using dramatised scenarios to foster discussion in online management courses

Keith Tyler-Smith
Christchurch Polytechnic Institute of Technology

Role playing, scenario-based activities and video dramatisations have been used extensively in management training for the past thirty or so years. In the online environment there has been keen investigation in the use of computer generated simulations as well as online role playing games intended to engage learners and replicate, as near as possible, the sorts of problems, decisions and judgements that a manager might face in the so called real world.

This poster presentation is a case study of the development and implementation of a low cost, low-tech approach to developing effective, engaging and realistic dramatised scenarios that uses a combination of visuals, audio and text.

These scenarios tell the story of a work group in a public service ministry. They are designed to engage public sector workplace learners with the complexity and infinite variability of human relationships and the dynamics of social groups, whether in the workplace, on the sports field or at home.

The learner is required as part of a group-based activity to investigate the dynamics of a team under pressure within a typical public sector organisation environment. By engaging with and reflecting on this affective content in an online environment the learners are able to gain insight and understanding of group dynamics in way that provides the learner with a multi-sensory experience, not available in text only content.

Keywords: online discussion, scenario-based learning, modelling, role-playing, group-based learning

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Poster presentation

21st Century higher education management: Networked educational management

Philip Uys
Charles Sturt University

Various questions arise when considering the interplay between digitally enhanced learning and conventional forms of learning, and the effects of this interaction on educational leadership and management. Is it practicable for conventional higher education to embrace digitally enhanced learning fully within its current management practices, or are new forms of educational management required? The writer's PhD (2000) focussed on the implementation and management of digitally enhanced learning and in particular networked learning in higher education, during which he developed the networked educational management framework. This model addresses the distributed nature and human issues present in a digitally enhanced learning environment. This paper therefore presents a key aspect of the doctorate research of Uys (2000) since 1995 grounded in literature on educational management. It further uses a comparative analysis of three case studies over nine years that reaches beyond the doctorate research. These case studies are the eLearning implementation on the Wellington campus of Massey University, New Zealand from September 1995 to December 2000, a five-month consultancy in 2000 at the Cape Technikon, South Africa to lead the enterprise-wide wide implementation of eLearning, and four years of implementing eLearning at the University of Botswana up to January 2005.

Keywords: higher education, management, networked educational management, organisational change

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Poster presentation

Developing effective digitally-enhanced blended learning environments: A comparative study of Australian universities

Philip Uys, Janet Buchan, Linda Ward
Charles Sturt University

Blended learning has become a prominent trend in university learning and teaching. This raises various questions for traditional distance as well as face-to-face universities internationally and in particular in Australia. A key area where many issues arise is the development process to create effective digitally-enhanced learning environments within a blended learning milieu. A comparative study of Australian Universities has been conducted in 2006 to identify factors in the development of learning materials and environments that support effective blended learning that is digitally enhanced. The prominent team-approach for the development of learning materials (Bates, 1993; DEC working party, 1989; Garrison, 1989; Holmberg, 1995) has been one of the foci of the study. Innovative approaches have been identified in learning material development that could benefit both Australian and international universities that are pursuing blended learning which is digitally enhanced.

Keywords: blended learning, instructional design, higher education, collaborative learning

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Poster presentation

Blending synchronous and asynchronous forms of communication in an online teacher education class

Miriam Weinel, Chun Hu
University of Sydney

Educational settings in tertiary institutions these days are often constituted by characteristics that address the specific needs of today's culture. One of these needs is the notion of being free of time and place constraints. Typical scenarios resulting from such needs are distributed group settings whose communication and collaboration is supported by technology. This paper focuses on the use of Information Communication Technology (ICT) in a teacher education class. We will describe the flexible implementation of chat rooms and discussion forums as communication means in computer-supported learning settings. Special emphasis is placed on students' perceptions of media usage and their development as the learning process unfolds. Initial results show that a low level of ICT experience as well as ICT usage in private settings do not provide a sufficient skill set to cope with ICT usage in learning settings. We underestimated the initial low level of ICT acceptance as well as participants' difficulties to adapt existing ICT skills from private usage to application in learning settings. The occurring difficulties are not an exceptional phenomenon in teacher education in higher education institutions. Special attention has to be paid to particular needs of students in teacher education.

Keywords: CSCL, computer-mediated communication, synchronous chat, asynchronous discussion forum, teacher education

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Poster presentation

Online learning modules: Does one version fit all?

Alexandra Yeung, Siegbert Schmid
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Roy Tasker
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The use of information and communications technology (ICT) has an increasing influence on teaching activities in higher education. Material such as online pre-laboratory work can be accessed by students off campus at any time to allow students some timetabling flexibility whilst offering the university a cost effective means of delivery. This poses the question: does one version of any online activity benefit students with different levels of prior knowledge? This study investigated the effectiveness of online pre-laboratory work modules on students' learning and their academic performance in a related practical exercise and the final examination. It clearly demonstrated that students, with a relatively poor chemistry background prior to commencing university study, who completed the module performed significantly better in a laboratory titration assessment and final examination than those who did not complete it, indicating the benefits of the module for students with weaker chemistry backgrounds. Furthermore, this study has shown that not all students benefit from the one version of the online modules. Therefore, adjusting the online modules to cater for students with varying levels of prior knowledge may be beneficial in helping all students to achieve improved outcomes.

Keywords: online learning, higher education, online pre-laboratory work, instructional design

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Poster presentation

Multimedia learning and the World Wide Web: Considerations for learners with a mental retardation

Peter Zentel, Maria Opfermann, Jan Krewinkel
Knowledge Media Research Center, Tübingen

The World Wide Web as a source of information retrieval has become increasingly important. Web-based environments allow for combining different representational codes and addressing different sensory modalities which might be especially beneficial for users with special needs (e.g., for blind people or for people with reading and writing disabilities). Our study investigates which representational formats are beneficial to foster recognition and understanding of mentally retarded users. As factors, we varied modality (visual, visual + auditory) and codality (text, text + pictures) aspects which led to a 2*2 design, whereas visual information was presented by means of symbols. Dependent variables were recognition, understanding, concentration and motivation. Participants are students from schools for special educational needs. Preliminary results show that they profit mostly from auditorily presented information whereas purely textual information leads to the lowest performance. This is in line with our expectations because research shows that only a few learners with mental retardations are able to process written language in a meaningful way. The studies are still being conducted and we expect final results within the next weeks. These results will be presented and discussed with respect to their implications for ways to make web-based environments more accessible to disabled users.

Keywords: disabled learners, mental retardation, multimedia learning, multiple representations

This study is funded by the German "Landesstiftung Baden-Württemberg".

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Workshop

What makes blended learning "good"? A conceptual model supported by real examples

Josie Csete, Paula Hodgson, Peter Duffy
Hong Kong Polytechnic University

Length Half day

Objectives Participants will:

- develop a general understanding of the capabilities of eLearning in enhancing online interactions;
- view a variety of working examples in which the Web can be used for learning (either offline or online);
- be involved in hands-on sessions for each of the 3 types of interaction in which they try out the working examples; (3 types of interaction within this workshop are enhancing interactions with content, with instructors, and with peers).
- be involved in discussions regarding the potential benefits and drawbacks to learners and facilitators of eLearning by using a specially designed eLearning decision worksheet.

Please refer to http://e3learning.edc.polyu.edu.hk/examples.htm for the examples that will be accessed during the workshop.

Intended audience Any conference attendees, no prerequisite experience

Facilitators **Dr Josie Csete** BA, MA, PhD.
Josie has a PhD in Educational Systems Development and more than 15 years experience in designing, developing and implementing educational innovations as well as teaching others to do so. She has been working at Hong Kong Polytechnic University since 1995 - in a department charged with "improving the quality of teaching and learning" on a campus of over 1,000 full time teaching staff and over 15,000 undergraduate and graduate students. She was the Principal Project Supervisor of the "e3Learning Project" and is now the Section Leader of the newly created "e-Learning Development and Support Section" at the Hong Kong Polytechnic University.

Dr Paula Hodgson BPhil., M.Sc., DBA.
With good experiences in design and delivering online learning and sound knowledge in human resource management and development, Dr Hodgson is very competent in delivering both face-to-face and online programmes. Dr Hodgson was one of the pioneers in promoting and supporting e-Learning in Hong Kong. She served in the Hong Kong Polytechnic University in two consecutive University Grants Committee funded projects in Hong Kong. Competent in counseling with clients and addressing their needs, she has an established track record in serving clients from different disciplines. She has had extensive experience in supporting clients from Health and Social Sciences, Communication, Business, Applied Science and Textiles, and Hotel and Tourism Management. Samples of good practices of eLearning can be viewed at http://e3learning.edc.polyu.edu.hk/examples.htm. In 2005, she worked in the Centre for Professional Development from University of Auckland, the leading research-led university in New Zealand. Rejoining the Hong Kong Polytechnic University in 2006, she continues her interest in supporting academics to embrace technologies for learning and teaching focusing on blended learning.

Peter Duffy DipT, Grad Dip (Curric) Med, PhD Candidate.
Peter has been involved in the use of technology and education since 1990 in various education contexts. He has recently joined The Hong Kong Polytechnic University as an Instructional Designer and previous to this worked at the Queensland University of Technology as a Learning Designer. He also has extensive experience in industry in developing eLearning products and a research interest in mobile learning, game design and interface design. He has presented at various national and international conferences on technology and education, in particular with an art and design focus. His PhD title is "The Artistic Interface": A Phenomenographic Study of Students' Conceptions of the Graphic User Interface in an Art Educational Environment.

Details of activities

The session has been intentionally designed to appeal to a broad range of conference attendees. First, the session should appeal to both novices and individuals who are more experienced with web learning technologies as it provides both an overview of learning approaches with illustrative working examples of applications, as well as overarching concepts and principles that can help participants make plans that are appropriate to their own contexts and learners.

Second, the session should appeal to people from a variety of organizations and application areas as it contains examples from a wide range of disciplines and the concepts to be presented have been purposely developed to apply across a wide range of situations. This is because the session is drawing upon experiences gained from a government funded project that served teachers in a variety of disciplines (such as medicine and the allied health sciences, language teaching, business and engineering) in three different universities.

Format of session

1 Introduction: Enhancing interactions (within the following three areas – interactions with content, with instructors, and with peers) through eLearning. (~20 minutes).

2 Interaction with Content: Demonstration \ Hands-on exploration \ Discussion (~45 minutes):
- Just-in-time information through online references.
- Better explanation of dynamic concepts through animation and simulation.
- Application of concepts through online cases.
- Improvement of procedural knowledge through videos.
- Consolidation of knowledge and skills through self-assessment with feedback.
- Learning through playing educational games.
- Increasing accessibility through mobile-learning.

3 Interaction with Instructors: Demonstration \ Hands-on exploration \ Discussion (~40 minutes):
- Clarification of ideas with teachers through chat-rooms and discussion forums.
- Extended discussion on news and controversial ideas.
- Answering participants' questions about the course using forum & FAQ.
- Sharing expertise through video conferencing.

4 Interaction with Peers: Demonstration \ Hands-on exploration \ Discussion (~45 minutes):
- Building an online learning community.
- Peer learning through online group work.
- Challenging each other's ideas through peer commenting and discussion.
- Reflective learning through peer critiques and revision of assignments.
- Building a larger learning community through inter-cultural exchanges.
- Better understanding through synthesis and creation by doing multimedia projects.

5 Discussion: Strengths and weaknesses of employing eLearning ideas in actual courses and how to do it. Participants will complete the eLearning decision worksheet specially designed for this workshop. (~25 minutes).

6 Summary and next steps: Handing over of CDs with (free and non-commercial) web site containing materials from this session as well as other information so they may further pursue their interest in eLearning. Sharing of ideas about how to apply the eLearning tools and methods in own context. (~20 minutes).

References

Please refer to http://e3learning.edc.polyu.edu.hk/ResourcesOverview.htm for links to the many publications and workshops developed from this project.

Workshop

Online information literacy e-learning modules from the OIL project: Project background, module use, and adaptation for use in new contexts

Bronwyn Hegarty
Otago Polytechnic, New Zealand

Jenny McDonald
University of Otago, New Zealand

Dawn Coburn
Dunedin College of Education, New Zealand

Length Full day

Objectives

The workshop is based on the outcomes of the *e-CDF*[i] *423 Information Literacy e-Learning Modules* project, funded by the Tertiary Education Commission in New Zealand. The aim of this 2-year project is to develop a range of on-line modules, predicated on the ANZIIL standards of information literacy (Bundy, 2004[ii]), and amenable to adaptation and use in a range of contexts. The project was conceived to address four main areas in the tertiary sector associated with information literacy[iii] learning:

- Barriers to tertiary study which can occur as a result of poor information literacy skills and the diverse needs of marginalised, mature and distance students.
- A shortage of high quality online information literacy modules which are reusable, portable and have pedagogical flexibility.
- A need for professional development opportunities for staff in the area of information literacy.
- A tertiary sector requirement for centrally maintained and managed, standards-conformant, online resources in this important foundation field.

By the end of the workshop, it is intended that participants will be able to:

- discuss information literacy needs and practices in tertiary settings,
- identify and use interactive online resources to support information literacy in the tertiary sector,
- explain models and elements of design for interactive learning systems,
- access and critique the project online information literacy modules,
- discuss factors associated with reusability of online resources,
- understand an approach to customising existing online information literacy modules,
- create new resources for online learning using the online information literacy modules and an adapted open source content management system (Magnolia),
- identify and discuss some processes associated with evaluation research.

Intended audience

The workshop is suitable for a wide range of staff in the tertiary sector, both beginners and more advanced practitioners: educational designers and programme developers, academic staff, librarians, technical staff. It is open to all conference attendees who have an interest in exploring innovative resources to support information literacy, and would like to experience first hand an easy to use editor for online resource development. The modules can be used in a range of learning settings: blended, fully online or face-to-face.

Facilitators

Bronwyn Hegarty - MSc (Dist), BSc (Hons), Diploma of Teaching (Tertiary), Graduate Certificate in Clinical Teaching, RGON.
Bronwyn has been teaching online and developing resources for the online environment for ten years. She currently works in the area of educational development at Otago Polytechnic. Bronwyn's role is to assist academic staff with the design and development of online courses, as well as to support them as they learn to become online facilitators. In the eCDF *Information Literacy e-Learning Modules* project, Bronwyn has been part of a team designing and developing content for the modules, and also oversees evaluation of the modules. Bronwyn is also a Doctorate candidate with the University of Wollongong investigating how a reflective framework may be used to help professionals develop skills of reflective practice, and evidence which may be suitable for inclusion in an electronic portfolio. Bronwyn’s blog: http://bahtings.blogspot.com

Jenny McDonald – MB.ChB, Dip.Grad.
Jenny has managed many major educational resource development projects in the last 7 years and directs the work of Educational Media, Higher Education Development Centre, at the University of Otago. A key part of her role involves working with academic staff to develop and evaluate e-learning projects and liaising with the Educational Media production team. In the eCDF *Information Literacy e-Learning Modules* project, Jenny has been part of the design, development and evaluation teams, and is also the project manager.

Dawn Coburn - MA, BA, Dip Soc Sci Computer Science, Dip Teaching.
Dawn has a teaching background and she has been working in what is now called e-Learning for the last eleven years; firstly in an area school and latterly at Dunedin College of Education. Dawn’s role at the college currently includes; across the curriculum ICT liaison, delivering a multimedia course, staff support for online learning, digital resource development and collaborating in the eCDF project.

Details of activities

Part One

The facilitators will provide an overview of the project, and will demonstrate the project site and resources.

- **Activity:** Pair and group discussion about information literacy needs and practices in their organisations, and the information literacy needs for tertiary teaching and learning.

Part Two

The facilitators will explain the models and elements of design which have been included in the OIL modules.

- **Activity:** Group discussion about design principles for engagement and learning.

Part Three

Hands on use of OIL modules

- **Activity:** Participants will spend time exploring some of the online information literacy (OIL) modules.
- **Activity:** Participants will critique the modules using an evaluation questionnaire.

Part Four

There will be an overview of factors associated with the reusability of online learning resources, and a demonstration of the open source content management system (CMS) used for creating the modules.

- **Activity:** Hands on use of the CMS and customisation of modules selected by participants

Part Five

An overview of the evaluation and research processes used in the project.

- **Activity:** Group discussion about participants' experiences with prototype evaluation processes – usability, expert review, formative and summative evaluation.

References

Project website: http://oil.otago.ac.nz. The five completed modules and the following publications can be viewed there.

Keen, D., Ritson-Jones, W., Coburn, D. Hegarty, B. & McDonald, J. (2006). Real Use Research Evaluation Report For Module One – Essay Writing, eCDF 423 Information Literacy eLearning Modules Project. University of Otago: Ministry of Education.

Hegarty, B., (2005). Analysis and Evaluation Group. Evaluation Report Essay Writing - Usability of Prototype Results for Information Literacy e-Learning Modules - Reusable and Portable across a College of Education, a Polytechnic and a University. University of Otago and Tertiary Education Commission. Available at: http://oil.otago.ac.nz

Hegarty, B., Coburn, D. & Darling, V. (2005). Needs analysis report for information literacy eLearning modules project. University of Otago and Tertiary Education Commission. Available at: http://oil.otago.ac.nz

[i] eLearning Collaborative Development Fund - Tertiary Education Commission

[ii] (ed.) Australian and New Zealand Information Literacy Framework, *principles, standards and practice*. 2nd edition. Adelaide: Australian and New Zealand Institute for Information Literacy (ANZIIL).

[iii] Information literacy is a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively as needed (ALA, 2006).

Workshop

Designing engaging online learning experiences

Anouk Janssens Bevernage, Sue Dark
Open Polytechnic of New Zealand

Length Half day

Objectives

Engaging the online learner remains a major challenge for e-learning designers and facilitators. How do we inspire the learner and energize the learning environment without any visual clues and when learning is not taking place concurrently?

This workshop introduces some of the basic concepts of engaging and collaborative learning design for online environments. Workshop participants will be given an opportunity to experience hands-on what it takes to make this happen.

At the end of the workshop, the participants will be able to:

- discuss and construct principles for engaging learning design for online delivery;
- explain what makes an effective online learning design to foster collaborative learning;
- design an inspiring online group activity;
- recommend facilitation approaches to promote a 'learner-centred' learning experience in a virtual learning environment.

Intended audience

E-learning practitioners with intermediate level experience in working with virtual learning environments.

Facilitators

Anouk Janssens-Bevernage is the E-Tutor Advisor at the Open Polytechnic of New Zealand. She is involved in supporting learning design for online courses and in guiding Faculty to effectively facilitate in an online learning environment. Anouk is an economist/MBA and educationist. Her main interests include research on and application of good practice to online learning design and facilitation.

Sue Dark is the E-learning Director at The Open Polytechnic of New Zealand. Since obtaining her MSc in IT & Learning in the UK, Sue has worked in computer-based learning, training and e-learning for over 15 years in a variety of roles; instructional designer, staff developer and in management. Sue manages the Professional Development team and the Instructional Design team at The Open Polytechnic. She has been involved in a number of Government-funded e-learning capability projects within New Zealand, including the Open Source Virtual Learning Environment project, e-learning Guidelines project, eXe project and the Networked Education Pilot project. She engages with a range of national groups and forums and is particularly interested in instructional design.

Details of activities

Welcome and introduction

Plenary discussion/interaction on 'engaging learning'

- Visual presentation of a number of real learning situations (podcasts; lecturers' notes downloadable from VLE; online drag and drop graphical diagram; animated story and questions; chat; sharing thoughts on discussion forum).
- The voting process is made enjoyable and initiates lively discussions
- The discussions are supported by a visual presentation with further questions to prompt higher order thinking about 'engaging learning'
- The key characteristics of 'engaging learning' are noted on flipcharts to be summarised and used as a reference for the group activity (see below)

- Presenters underpin questions with reference to their experiences with e-learning design and delivery

Introduce group activity

- The participants are given a learning outcome from an environmental management course (the learning outcome inspires a broad range of professionals).
- Six groups of five are formed (or less groups if less than 30 participants).
- Groups are asked to design one ‘engaging collaborative learning activity’ that supports the learning outcome and that should be developed in a virtual learning environment. Their instructional design proposal should include thoughts about facilitation requirements and virtual class management issues.

Group work

- Presenters support individual groups by asking additional questions on their respective activities.
- Groups appoint their representative for group feedback.

Group feedback to plenary

- Each group takes a few minutes to describe their engaging activity for a virtual learning environment and explain why they think it is engaging.
- Other groups are invited to ask questions and to provide feedback.

Summary and closure

References

Previous presentations of the workshop:

Designing engaging online learning experiences
Moodle Moot (Wellington 3-4 July 2006)
http://www.moodlemoot.org.nz/moodle/

Upcoming:
Designing meaningful collaborative online group work
eFest (Wellington 27-29 September 2006)
http://www.efest.org.nz/programme.html

This workshop is derived from day-to-day practice at the Open Polytechnic of New Zealand, where the process is used to support course redevelopment for online delivery.

Workshop

Architectures for effective online learning and performance

Elena Kays, Rod Sims
Capella University

Length Full day

Objectives

The workshop is designed as an interactive and participative session where the presenters will pose key challenges in the creation of emergent, engaging, interactive and motivational online learning environments. Using multi-disciplinary perspectives, participants will engage in discussions and activities designed to contextualise these challenges and develop environmentally-specific design and development solutions for their individual online learning programs. On completing the workshop, participants will also have a set of tools to support the construction of their own "online architectures".

The expertise of Dr Kays and Dr Sims in the international higher education sectors, in instructional design, learning design and contemporary online learning environments will ensure that participants will develop their knowledge and skills to maximise the success of their own online teaching and learning practice.

At the end of this one-day workshop, participants will have:

- reviewed and critically reflected on the key components for effective online learning;
- analysed the major issues that confront and prevent designers from achieving the full potential of online learning;
- synthesised the key elements required to construct Architectures for Online Learning, including emergent design, proactive evaluation and interaction metrics;
- participated in a case study of their own workplace environment to implement contextual and functional Online Learning Architecture;
- access to a full set of resources and tools to develop and implement more complex online learning architectures within their workplace.

Intended audience

The intended audience for this workshop are educational designers responsible for supporting online learning pedagogy, academics implementing online environments and instructional, educational and curriculum designers from the training and education sectors. The workshop will also benefit those who are keen to better understand strategies to realise the full potential of online learning environments.

To maximise the outcomes of the workshop, participants should be familiar with current online learning development and delivery environments, and be active in the implementation of online environments within their own organisations.

Facilitators

Dr. Elena Kays has worked in the field of higher education for the last fifteen years. For almost a decade, she has focused exclusively on designing, developing, and implementing innovative online learning environments. She has published numerous papers relating to the advancement of design process and methodology, dynamic and emergent instructional design models, and building collaboration and rapport in the online environment. Dr. Kays is currently an adjunct professor in the Graduate School of Education at Capella University and in addition to doctoral supervision, teaches various courses from ethics to interface design. Dr. Kays is also the president of the EJK Consulting Company.

Dr Rod Sims has worked in the technology and education field for over 25 years. During that period he has seen significant change both in the technology we use and the ways in which we design educational environments to effectively use that technology. Rod has worked as both a consultant in educational technology as well as designing and implementing undergraduate and postgraduate programs at the University of Technology Sydney and Southern Cross University. Over the last three years Rod has been working as an Adjunct Professor with the US-based Capella University, with responsibilities for online teaching, course development and PhD supervision in the field of Instructional Design for Online Learning. Rod has presented widely in Australia and internationally and is well known for his work on the design of interactive and engaging learning environments.

Details of activities

Workshop format and activities

The workshop is divided into morning and afternoon sessions. The morning session will focus on the underpinning principles and practices that enable Online Learning Architectures to cater for different learning and performance environments. The concept of ‘architecture’ as a framework for online learning will be presented and analysed. Examples from different disciplines will be used to highlight the ways in which online learning can benefit from emergent thinking. This will include the integration of:

- Emergent modelling strategies: the importance of applying a multi-disciplinary approach to the creation and implementation of contemporary online learning environments that cater for the dynamics of social networking;
- Principles of online pedagogy: presentation and analysis of the key factors that contribute to the development of contextual and individual online learning applications; and
- Metrics for interaction: presentation of heuristics and metrics that identify and underpin the critical elements of interaction that facilitate engagement and construction of meaning.

The afternoon session will involve a case-study where Online Learning Architectures will be applied to settings associated with different learning outcomes and contexts.

At the conclusion of this workshop, participants will have a complete set of tools to create e-learning environments or ‘architectures’ that are interactive, engaging, economic and outcome oriented.

References

Previous presentations:

This workshop was successfully presented at AusWeb 2006 (http://ausweb.scu.edu.au/aw06/conf/workshops.html)

Recent references that will support the delivery of the workshop include:

Irlbeck, S., Kays, E., Jones, D. & Sims, R. (in press). The phoenix rising: Emergent models of instructional design. *Distance Education, 27*(2).

Kays, E. (2003a). Architecture and Instructional Design: A model for e-learning. *E-Learn 2003: World Conference in E-Learning in Corporate, Government, Healthcare, & Higher Education, Phoenix, AZ*, 257-264.

Kays, E. (2003b). Creating emergent discourse: A critical ingredient in e-learning. Proceedings of *E-Learn 2003: World Conference in E-Learning in Corporate, Government, Healthcare, & Higher Education*, Phoenix, AZ, 252-256.

Kays, E. (2003c). The four pillars of rapport: A critical ingredient in e-learning. *Proceedings of the Interior Design Educators Council International Conference, San Diego, CA*, 46-48.

Sims, R. & Hedberg, J. (in press). Encounter theory: A model to enhancing online communication, interaction and engagement, in C. Jawah (Ed.) *Interactions in Online Education: Implications for Theory and Practice*. London, UK: Routledge Education.

Sims, R. (2006). Beyond instructional design: Making learning design a reality. *Journal of Learning Design*, *1*(2), 1-8. (Keynote Paper) Available online: http://www.jld.qut.edu.au/ (16th May 2006).

Workshop

Giving effective and interactive presentations

Tony Koppi
University of New South Wales, Australia

Elaine Pearson
University of Teesside, UK

Length

Half day

Objectives

The purpose of the workshop is to help presenters to get away from the 'death-by-PowerPoint' that so many of us are subjected to at conferences. A traditional approach seems to be to have as many slides as possible and to talk quickly in the short timeframe often allowed at conferences. Adopting a more educational approach based on learning and teaching principles (that presenters no doubt apply elsewhere) helps overcome the traditional transmission model so often used at conferences.

By considering a particular educational model (which is not prescriptive), objectives are to enable participants to consider their presentation style in relation to learning outcomes for both the presenter and attendees, and to engage the audience in acceptable, relevant and meaningful activities.

Intended audience

This half-day session is particularly suitable for delegates who may be new to conference presentations, or more experienced presenters who feel they would like to revise or improve their presentations.

Facilitators

Associate Professor Tony Koppi is Director of the Educational Development and Technology Centre (EDTeC) at the University of New South Wales. Tony has researched, published and presented internationally on aspects of learning design and educational technology for the last ten years. Recently, he was a keynote speaker on Soil Science Education at the 18th World Conference on Soil Science in Philadelphia, 2006. He is a member of the program committee for ED-MEDIA, and on the editorial panel of a number of educational technology journals.

Dr Pearson is Director of the Accessibility Research Centre (ARC) and a Principal Lecturer in the School of Computing at the University of Teesside. She has published and presented extensively in journals and conferences in the UK, Europe, North America and Australia on the subject of accessibility and online learning, and is a member of the editorial board for a number of journals. She was invited Co-Chair for the World Conference on Educational Multimedia, Hypermedia and Telecommunications (ED-MEDIA), 2006 and is a member of the program committee for the Association for Learning Technology Conference (ALT-C) in the UK.

Details of activities

The rationale for this workshop is that a presentation should not be a summary or repetition of the paper, but can more profitably be used through discourse to develop ideas, arguments, theories, and strategies arising from the paper.

The COERSEA model (context, outcomes, engagement, resources, support, evaluation, alignment) comprises seven principles that can be flexibly applied to the design of any presentation be it a lecture, seminar or conference paper. The model represents a constructivist approach to presentations that engages participants in a shared learning experience. It has been successfully applied to a number of topics and contexts at conferences, seminars and workshops.

The model has broader applicability and can be adapted for the classroom setting as an alternative to the traditional lecture or to design workshops, and compliments current trends in online learning design.

Participants will explore more effective ways of representing their ideas as an alternative to the traditional 'transmission' approach to presentations. They will identify ways to encourage other perspectives on their paper, engage the audience, and initiate feedback and reflection. Taking their own ascilite 2006 paper (or some other prepared presentation or plan thereof), participants will develop a presentation that avoids the 'death-by-PowerPoint' that we are so often subjected to at conferences. With the support of the facilitators and their fellow participants, each attendee will produce the PowerPoint slides, resources for engagement; evaluation and feedback mechanisms, to create an engaging and interactive presentation. Participants may bring a laptop if so desired but the entire exercise can be carried out on paper since an outcome of such a presentation style is to have few PowerPoint slides.

References

The ideas presented in this workshop have been articulated and developed in the following paper:

Koppi T, & Pearson, E.J. (2005). The COERSEA model for interactive presentations. *Journal of University Learning and Teaching Practice (JUTLP),* 2(2), http://jutlp.uow.edu.au/

The concepts have also been presented in various forms in workshops and conference papers (revised as a result of the feedback from each session) as follows:

Pearson E. J. (Invited Speaker). (2006). Effective and Engaging Presentations, *World Conference on Educational Multimedia, Hypermedia and Telecommunications (ED-MEDIA),* Orlando Florida, USA, June 2006.

Pearson E.J. & Koppi, T. (2004). Creating an interactive conference presentation, *AACE World Conference on Educational Multimedia* ***(****EDMEDIA 2004),* Lugano, Switzerland, June 2004.

Koppi A. J. & Pearson, E. J (2003). Re-thinking the pedagogical approach to presentations: the COERCEA model, *ALT-C*, Sheffield, UK, September 2003.

Koppi A. J. & Pearson, E. J. (2003). No more Death by Powerpoint, *AACE World Conference on Educational Multimedia (ED-MEDIA 2003),* Hawaii, USA, June 2003.

Also:

Koppi, T. (2004). *Giving Interactive Presentations*, EDTeC Staff Development Seminar, University of New South Wales, Sydney, Australia, March 2004.

Workshop

How to develop 'on-demand and on-the-go' ubiquitous educational multimedia for connected communities

Margaret M. Maag
University of San Francisco

Length Full day

Objectives

An interactive technological tool that facilitates different forms of online communication, learning, and collaboration among educators, students and colleagues across international borders will be presented, demonstrated, and taught to workshop delegates. Participants will create their own blogs while demonstrating an understanding of RSS.

At the completion of the workshop, participants will be able to:

- summarize the basic format, function, and use of blogs;
- describe the potential use of blogs in education, professional development, and virtual conference participation;
- implement provided Free/Libre/Open-Source Software (FLOSS) to create a personal and "team-ascilite conference" blog;
- create a RSS feed by using a source, such as *Feedburner;*
- summarize the basic set-up, purpose, and use of podcasts;
- explain the potential use of podcasts in education, professional development, personal use, and virtual conference participation;
- implement provided FLOSS software to create a unique podcast;
- create a smartcast feed by using a provided source;
- design and organize an enhanced podcast;
- tell the instructor the technical components of a vodcast.

Participants will find the provided content useful when teaching an online, traditional, or blended course; setting up a professional development site; or when virtually interacting at a professional meeting, such as NI 2006 in Seoul, Korea (http://ni2006.blogspot.com/).

Intended audience

The intended audience is educators, staff developers, conference organizers, administrators, librarians and anyone who is interested in learning how to develop mobile learning and conferencing tools. The participants should have an intermediate to advanced level of understanding in order to understand the workshop topic and presented materials.

Facilitator

Margaret Maag Ed.D., MSN, RN has previously presented at national and international conferences on podcasting, blogging, and online learning.

Details of activities

Blogs:

- Historical background of blogging;
- How various software packages function;
- The range of blog types;
- The potential for use in teaching, learning, and professional development with emphasis on the promotion of human interaction through blogging ;
- Workshop participants create their own blogs (enabling them to participate in "team blog" activities and presentations during the ascilite conference;
- Explanation of RSS concept ;
- Construction of dynamic web pages by using RSS feeds.

Podcasting:

- Art and history;
- Potential for use in teaching, learning, professional development and virtual conferencing;
- Participants will create their own podcasts;
- Enhanced podcasts using selected shareware and freeware software.

Vodcast:

- Introduction to the technical aspects of creating a vodcast.

References

Faculty development workshop at the Center for Instructional Technology at the University of San Francisco, April 2006.

Lead author for a similar workshop at the University of Wisconsin, Madison, Distance Learning Conference, August 2, 2006.

Margaret Maag conference presentations:

Ed-Cast: An International Podcasting Collaboration to Enhance Access and Knowledge. 22nd Annual Conference on Distance Teaching & Learning, University of Wisconsin-Madison, Madison, Wisconsin, August 4, 2006 (Co-Presenter of a Paper)

Blogging, RSS, and Podcasting: Interactive Online Teaching, Learning, and Virtual Conference Tools 22nd Annual Conference on Distance Teaching & Learning. University of Wisconsin-Madison. Madison, Wisconsin, August 2, 2006 (Half-Day Workshop Presenter)

Podcasting: A Learning Tool for the Nursing Nomad . 20th Annual Nursing Research Symposium California State University, Fresno. Fresno, California, April 28, 2006 (Presenter)

An Education Podcast Repository-Building Teaching and Learning Synergies Among Higher Education Institutions 2006 EDUCAUSE Western Regional Conference San Francisco, CA, April 25, 2006 (Poster Presentation)

M-Learning Technology: Mobile and Multimedia Modalities for All Learners Technology Day 2006: Teaching in the Digital Domain. University of Illinois, Springfield, Illinois, April 14, 2006 (Keynote speaker)

Online Learning: Hyper Linking Higher Education to the Future. Seton Hall University Faculty Winter Institute Workshop, South Orange, New Jersey, January 5, 2006 (Co-keynote speaker)

Podcasting: A New Medium for a New Voice in Healthcare Education Eleventh Sloan-C International Conference on Asynchronous Learning Networks, The Power of Online Learning: Mobilizing to Expand Community Orlando, Florida, November 17-19, 2005

Blogs, podcasts, wikis and other exotic beasts: Their use in nursing informatics education, professional development, and virtual conference participation. 1. Panel Presentation. *Podcasting: An emerging technological in nursing education* 2. Poster Presentation: The 19th International Congress on Nursing Informatics, Seoul, South Korea, June 8-17, 2006

Ed-Cast: An Education Podcast Repository (www.ed-cast.org) 24th Annual International Computer and Technology Conference. Toronto, Canada May 25-28, 2006. *State of the Art of the Use of Technology*: Poster Presentation

Workshop

Embedding quality guidelines into e-learning practice

John Milne
Massey University, New Zealand

Andrew Higgins
Auckland University of Technology, New Zealand

Length

Half day

Objectives

- To be aware of the e-learning quality guidelines.
- To identify various applications of the guidelines for e-learning delivery.
- To develop initial ideas for implementation approaches that embed the guidelines into local practice.
- To discuss the future developments of the e-learning guidelines.

Intended audience

This workshop is for staff developers, managers and those who are in positions to effect change within their organisations.

Facilitators

John Milne
Email: J.D.Milne@massey.ac.nz
John Milne was the project officer on the e-Learning guidelines project that was recently completed for the Tertiary Education Commission. He has facilitated staff development workshops in New Zealand and in the UK.

Dr Andrew Higgins
Email: andrew.higgins@aut.ac.nz
Dr Andrew Higgins is Director of Flexible Learning on the senior management team at the Auckland University of Technology. The University of Otago formerly employed him as senior lecturer in flexible learning. His background includes many years service with the Queensland Government in Australia, working variously in the Office of the Cabinet, as senior policy officer with Education Queensland, as Manager of the Queensland Police Service's Distance Education program, as Services Officer for AccessEd , as Co-ordinator of the Rural Secondary Schools Support Scheme and as a teacher. He has held appointments at the University of Western Australia, James Cook University and the University of Queensland.

Details of activities

How can a set of quality guidelines bring real performance improvements for e-learning practitioners? This workshop will introduce e-learning quality guidelines that are: flexible so that they can be applied to the diverse tertiary context, easy to use, and able to evolve as understanding on best practice develops. This workshop will explore how to apply the guidelines to a participant's institution and discuss their future development.

The workshop will be divided into six parts:

1. Welcome & introduction to guidelines, who needs them and why use them;
2. Group activity: write a scenario that draws on the key issues relevant to e-learning in your group. Start by discussing some of the key issues, shortlist a few of them and then write a short outline of these issues at a typical institution. Present the scenario to other groups.
3. Introduction to the e-learning guidelines and how to use them;
4. Group activity: Take a scenario developed earlier and research guidelines that can help with the scenario. Report back on findings;
5. Discussion of future developments of the e-learning guidelines;
6. Wrap up and summary.

References

Parts of this workshop have been run in various New Zealand universities, polytechnics, national and international conferences.

Milne, J. D. & Suddaby, G. T. (2005). e-Learning quality guidelines. Poster in H. Goss (Ed.), *Balance, Fidelity, Mobility: Maintaining the Momentum?* Proceedings of the 22nd Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education. (p. 481). Brisbane: Teaching and Learning Support Services, Queensland University of Technology.

Milne, J..D. (2006). e-Learning guidelines and how to use them. DEANZ Conference 2006: *Enabling E-Learning Approaches in C21*. 3-5 July 2006, Auckland University of Technology (AUT), Auckland, New Zealand

e-Learning guideline website: http://elg.massey.ac.nz

Workshop

A comprehensive introduction to Elluminate Live! A Web browser based synchronous learning and teaching environment

Stephen Rowe, Allan Ellis
Southern Cross University

Length Full day

Objectives Participants completing the workshop will be provided with:

- a demonstration of the approach developed at SCU for orienting staff to using Elluminate Live!;
- the knowledge and ability to use a range of features and tools available in the current version;
- the opportunity to connect and engage with national and international participants;
- an overview of a variety of instructional models that can be implemented;
- a forum to explore potential applications in the discipline areas of participants;
- access to the range of training and support resources available from Elluminate.

Intended audience Teaching staff (No previous experience with Elluminate Live! or other audiographics or Web conferencing software is assumed.)

Facilitators **Steve Rowe** is a Lecturer in the School of Commerce and Management. He is currently the designated administrator for Elluminate Live! at SCU. His research interests include online delivery approaches, most recently using asynchronous and synchronous tools for delivery and assessment. He has conducted numerous workshops for staff and students in the use of these tools.

Allan Ellis is an Associate professor in the School of Management and current Director of Research and Research Training. His research interests and publications are in the area of educational technology and adult learning. In the 90's, he was involved in the use of the audiographic package Electronic Classroom, and is involved with the current roll out of Eluminate Live!

Details of activities Participants will have the opportunity to learn how Elluminate Live! combines many different tools into one interface creating a web-based classroom that can be used in real time, either with a whole class or with a group within a class. It works on a Mac or a PC (and other systems) and equally well on a 28k modem and broadband. It can be used by an individual (for recording and practice) or as many as feasible with the content, connections and bandwidth available. Two-way audio using voice-over Internet protocol (VOIP), video/webcam transmission, application sharing, text chat capabilities and the ability to breakout into groups. These features will be introduced early in the day and progressively utilised as the workshop progresses.

The workshop participants will be involved in a mix of demonstration, discussion, question and answer forums, and small group activities. There will be links within some of these activities to other sites both within Australia and overseas. Specific activities offered to participants that will allow the features mentioned above to be utilised include:

- **Introductions:** short round of personal introductions including expectations for the day. Outline of the days activities.
- **Basic orientation of features:** showcase of the range of features and tools available in the current version of the program, including setting up a client computer and a

very brief overview of the administration system. This will showcase the recording feature as well as an opportunity to learn how to use the participant management and interaction features.

- **Demonstrations session**: use of both live and recorded sessions to demonstrate the capability of the program to teach a variety of different subjects using a variety of teaching styles. Live sessions will involve links to both national and international participants.
- **Forums to explore and discuss instructional design and teaching issues**: participants will join in a live session with national and international guests to discuss the range of ways Elluminate Live is being used. Ideally, this will involve current users from London University, Deakin University, Adelaide University, Curtain University, and the TAFE sector.
- **Mini teaching sessions:** participants will engage in small group design work and a few mini teaching sessions to demonstrate just how easy it is to prepare and deliver material using selected tools.
- **Competing products:** Participants will be provided with links to resources comparing the features and costs of similar products for their evaluation.
- **Ongoing follow-up:** This session will conclude by ensuring that participants are aware of where they can explore the range of (free) support and training resources available for follow up even if they do not have access to a license.

References

A sub-session on Elluminate was presented at the recent AusWeb06 conference as part of the SIG day on educational technologies. Several staff development sessions have been presented on SCU campuses, and the proposers recently won a Vice Chancellor's Strategic Initiatives Award that includes funds to continue to support training in the roll out of Elluminate at SCU.

A joint paper on Elluminate Live! was presented at this year's AusWeb conference (July) and a paper has been submitted for presentation at this year's ascilite conference. One of the proposers also presented a paper (using Elluminate Live!) to the Illinois Online Conference (February, 2006) about preliminary feedback from first time users at SCU.

Workshop

Course re-design within a community of practice model

Diane Salter
Hong Kong Polytechnic University

Length Half day

Objectives This half day workshop is designed to allow participants to learn about the design and implementation of a new program for staff development initiated at Hong Kong Polytechnic University. The design of this programme provides a community of practice model for staff to work on course re-design. This approach can significantly reduce the amount of time needed for curriculum development at a minimal cost without compromising the creation of an effective learning environment. The implementation of this program, at the institutional level, includes Professional Development, Subject Development, Implementation and Evaluation and Dissemination.

In the workshop, in addition to learning about the program design and implementation, participants will learn about and apply the process of 'applied learning mapping' that faculty use as the framework for redesigning their course when they participate in this staff development program. The 'applied learning mapping' process is designed to shift instructors from a tendency to focus on content coverage and presenting content, to the design of a learning environment that promotes student interaction and engagement with the content.

Time for discussion on how the approach can be adapted and presented, using a combination of online modules and face-to face workshops to meet specific institutional needs will be incorporated into the workshop.

Intended audience This workshop is open to all conference attendees and will be of interest to teaching staff who are interested in learning about a model that they can immediately apply to re-design a course for blended learning. Participants may wish to bring along a course outline for their course to use during the applied activities.

The workshop will also be of interest to educational developers who wish to learn about a model for a programme that they may wish to introduce at their own institutions. The approach of the e –Scholars programme goes beyond the traditional offering of workshops/seminars for staff development to include the provision of on going support to a cohort of staff as a community of practice, while they initiate changes in their course design and delivery.

Facilitators **Dr. Diane Salter** has a PhD in Cognitive Science from the University of Toronto, a Masters Degree in Educational Psychology from the University of Calgary and over 16 years experience in leadership in higher education specializing in innovative approaches to e-learning initiatives. She is currently working in the Educational Development Centre at the Hong Kong Polytechnic University and has initiated the E-Scholars programme at this institution to guide faculty in innovative approaches to course re-design and delivery. Her leadership roles in Canada include leading innovation in program and curriculum development as Dean at the Sheridan Institute of Technology and Advanced Learning, and extensive work in technology innovation at the Centre for Learning and Teaching Through Technology at the University of Waterloo. Diane designs and facilitates 'Rethinking Learning' workshops to faculty internationally, including institutions in Canada, USA, Australia, Hong Kong, Sri Lanka and Thailand.

Details of activities

This session is experiential, and participants will learn about, discuss and apply the concepts of the e -Scholars Programme to their specific course or institutional needs. The E –Scholars Programme was designed to provide staff with:

- a planned course of professional development for staff to 'rethink' their courses as they redesign to incorporate a blended learning approach;
- direct funding (if needed) for development and implementation of the individual subject-level development work;
- in-kind instructional design support;
- systematic evaluation of learning impact.

In this workshop participants will:

- learn about the design and implementation of the e-Scholars Programme;
- learn about and apply the educational framework of the programme;
- apply the concepts of the applied learning mapping process to their own course or institutional examples;
- have time for discussion of examples and applications for their own course or institution.

The workshop is practical in nature, and participants will work on exercises in small groups and in large group discussions. Participants who are teaching staff will be able to draft ideas for how the model can be used for their own course re-design; participants who are staff developers may wish to consider application of this approach at their institution and will be able to draft and have feedback to their ideas.

References

Salter, D., & Richards, L. (2005). Designing for Learning: A Learning-Centred Approach to Curriculum Design. E-Learn, 2005, Vancouver, BC, Canada. Oct. 24-28, 2005. Association for the Advancement of Computing in Education. (accepted at ELearn but withdrawn by author due to conflict in dates – article in preparation for submission elsewhere for publication).

Salter, D., Collallilo, G. & Richards, L. (2005). This is IT. Nipissing University. Guiding Faculty in Innovative Curriculum Design. May 2005, North Bay, Ontario.

Salter, D., Edmunds, L. & Maynard, M. (2005). *Collaborative program development: A creative approach to institutional change.* League for Innovation. March. 6-9, 2005. New York.

Salter, D. & Richards, L. (2005). *From lecture to coaching: Engaging students to prepare for class.* Community College Baccalaureate Association (CCBA) Fifth Annual conference, March 4-6. New York. (Learning and Teaching Stream)

Krawiec, S., Salter, D. & Kay, E. (2005). *A 'Hybrid' Bacteriology Course: The Professor's Design and Expectations: The Students' Performance and Assessment*. Microbiology Education. 6: 8-13.

Salter, D. & Richards, L. (2004). *Guiding faculty in innovative curriculum Design*. E-Learn 2004, Washington, DC, USA, Association for the Advancement of Computing in Education, November 1-5, 2004, Washington, DC, USA.

Salter, D. & Richards, L. (2004). *Online feedback strategies for learning and teaching.* E-Learn 2004, Association for the Advancement of Computing in Education, November 1-5, 2004, Washington, DC, USA.

Salter, D., Richards, L. & Carey, T. (2004). *The 'T5' design model: An instructional design model to support the integration of online and campus based learning.* Special Issue: Educational Media International: Distributed Learning Environments: the convergence of distance and campus based learning.

Salter, D. & Richards, L. (2003). *Online activities to enhance class time: A task-based approach to Engaging students in large classes.* McGraw-Hill Ryerson Teaching, Learning and Technology Conference. Active Learning: Connect, Engage and Integrate. November. 24-25, Ryerson University.

Salter, D., Richards, L. & Carey, T. (2003). *A Task-based approach to integrate faculty development in pedagogy and technology.* E-Learn 2003, Arizona, USA, Association for the Advancement of Computing in Education. November.

Bringelson, Liwana S., Schoner, V., Howard-Rose, D., Salter, D. & Carey, T. (2003). , *Dialogues on Teaching: Creating a multi-site interactive learning technology faculty institute*. Paper present at ALT-C. Sheffield, UK; 8-10 September, 2003.

Harrigan, K., Carey, T. & Salter, D. (2002). *An Instructional Design Model for Learning Object Re-Use*. MERLOT International Conference, Atlanta, GA. September, 2002.

Workshop

Using iPods & iTrips as knowledge acquisition tools for problem-based learning in the workplace

Paula Williams, Beth Hobbs
Western Sydney Institute

Length Half day

Objectives Seventy-three percent of students surveyed in 2006 undertaking vocational training and education (VTE) training said that e-learning would in the future improve their employment outcomes (Australian Flexible Learning Framework 2006). This study further stated that, by integrating information and communications technologies (ICT) into VTE, it becomes more flexible and more responsive to client needs, improves quality and access and fosters innovation.

In this workshop, participants will:

- be introduced to and engage with Web 2.0 audio-visual tools and their current usage in vocational education and training;
- explore potential applications of ipods and itrip transmitters as tools for teaching and learning in the workplace;
- create and publish a mini ilecture using open source software for mobile devices;
- gain insight into how mobile communication devices can facilitate collaborative–based learning in today's workplace.

Intended audience This workshop is interactive and will cater to participants interested in workplace teaching and learning. Attendees will learn about and discuss innovative ways of applying the workshop's concepts to their specialised fields of practice.

Participants will work in groups to produce a mini lecture suitable for an ipod. This mini lecture will demonstrate how expertise and knowledge can be collaboratively shared without headsets and using only one ipod to a large number of people in the workplace. Participants will learn how itrips and radio transmitters can broadcast podcasts to the workplace. The idea of this workshop is to illustrate how trainees can use ipods and itrips as knowledge-acquisition tools to tap into expert instructional advice for in situ problem-based learning.

Facilitators **Paula Williams,** eLearning Development Officer
Western Sydney Institute, Open Training and Education Network for Technical and Further Education NSW, Strathfield, NSW 2135, Australia.
B.Ed (Hons) Adult Vocational Education, Diploma in Biomedical Sciences, Diploma Freelance Photojournalism, Diploma in Freelance Illustration Journalism. Currently completed first year Industrial Law Stage I & II at UTS, Sydney.

Beth Hobbs, Chief Education Officer Learning Technologies
Western Sydney Institute, Open Training and Education Network for Technical and Further Education NSW, Strathfield, NSW 2135, Australia.
BA Teaching in Adult Vocational Education, Grad Dip Computer Based Learning, Grad Cert in Facilitating and Managing e-Learning, CIV Training and Assessment, Diploma Business Administration. Currently studying Masters Adult Education UTS.

Details of activities

Participants will have the opportunity to engage with mobile technology and will leave the workshop familiar with 'web 2.0 services' that will further enhance their digital fluency for today's 'connected era'. The facilitators will invite consideration and discussion around the challenges and opportunities presented by web 2.0 and participants will have the opportunity to discuss and explore possible applications of these technologies in their institutional settings.

1 Welcome and introductions.
2 Introduction to ipods, nano ipods, videopods and other Mp3 like tools.
3 What are Web 2.0 tools and how can these technologies provide high quality in situ learning in the workplace.
4 Types of Web 2.0 services available such as audacity, podomatic and audioblogger for creating ilectures
5 Using ipods as one form of knowledge-acquisition tool to facilitate on the job training in the workplace.
6 Creating a mini lecture based on script provided.
7 Broadcasting lectures using radio frequency transmitters called itrips.
8 Discussing ipods as knowledge acquisition tools in the workplace.
9 Small Group exploration of the use of ipods and syndicating with RSS.
10 Introduction and exploration of some uses of ipods and itrips in tertiary education.
11 Discussion of the benefits of each approach.
12 Conclusion and wrap-up.

References

Previous presentations:

Williams: Versions of this workshop have been carried out with internal groups from the Western Sydney Institute of TAFE NSW; NSW Department of Education's Centre for Learning & Innovation (CLI)- Learning Design Forum and the International Centre for VET Teaching and Learning (ICVET) 2005 & 2006.

Hobbs: TAFE NSW International Centre for VET Teaching and Learning (ICVET) - Conference 2005 Presentation "Personalised Learning"

Williams & Hobbs: ICVET Conference 2006 Workshop and Showcase

Publication references:

The presenter has published and presented a concise paper for the Open and Distance Learning Association of Australia (ODLAA) for their 2005 Conference in Adelaide 'Tools of the Trade- Converging Technologies; conducted workshops for TAFE NSW Conferences –Evidence-Based Assessment in 2005 and 2006 for different solutions to evidence-based assessment using mobile devices; Conducted a qualitative unpublished research study entitled OTEN SMS Trial 2005 involving use of SMS to update and motivate students.
Participated in a NSW Board of Vocation Education and Training (BVET) project "Improving VET outcomes using personalised learning"

Bradshaw, D. (2005). 'Different Voices Different Spaces-A Good Practice Model in Action', Australian Flexible Learning Framework, DEST, Canberra 2005

Coghlan, M.(2004). 'Finding your voice online'-An inquiry into the Use of Online Voice Applications in Higher Education' The Knowledge Tree Australian Flexible Learning Framework http://www.elearn.wa.edu.au/kt/edition05/html/npra_michael_coghlan.html

Meng P. (2005). *Podcasting and Vodcasting: A White Paper, Definitions, Discussions & Implications*, University of Missouri, IAT Services. Retrieved 7 July, 2006 from http://edmarketing.apple.com/adcinstitute/wp-content/Missouri_Podcasting_White_Paper.pdf

The Knowledge Tree- An E-Journal of Learning and Innovation (ed.10); Going Aural; Australian Flexible Learning Framework; Department of Education, Science and Training; ACT July 2006

Workshop

Improving your publications profile

Craig Zimitat
ascilite executive

Length Half day

Objectives On completion of this workshop, participants should have a clear understanding of:

- the nature of a conference paper and journal articles;
- how to write a poster, conference paper, or presentation;
- the processes involved in peer review of journal articles;
- how to use and respond to feedback given by referees to enhance and publish a paper.

Intended audience This workshop is intended for new researchers or research higher degree students that are seeking to develop their academic writing skills, for successful submission of conference papers and peer reviewed journal articles.

Registration priority will be given to 'novice researchers', defined as persons enrolled full time or part time for a higher degree by thesis or by coursework plus a substantial research project. Next priority will be given to Associate lecturers, Teaching fellows and other junior academic staff of educational institutions who do not have a significant number of research publications; and then persons whose first language is other than English.

Facilitator **Dr Craig Zimitat** is Deputy Director of the Griffith Institute for Higher Education.

Details of activities Using authentic materials and small group format, the workshop will introduce participants to (i) the academic publication process (with the opportunity to examine reports from assessors and some microwriting exercises, role of editors etc.), (ii) selection of journals in which to publish (quality - rejection rate, impact factors, citation rates), and (iii) the writing process.

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