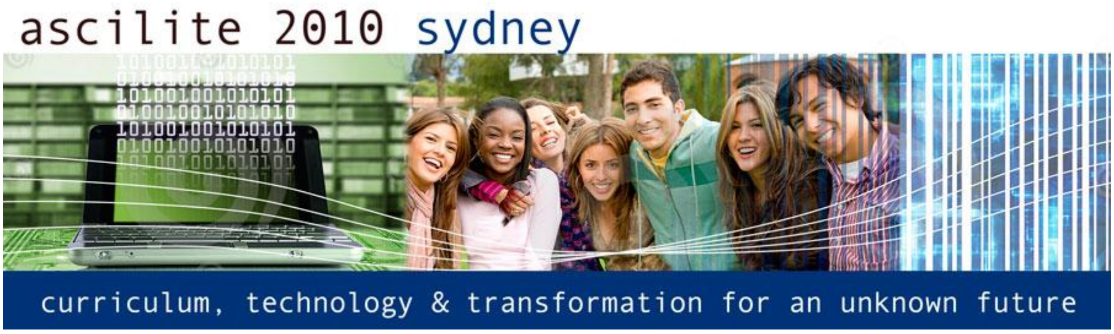

A model for transformation: A transdisciplinary approach to disseminating good practice in blended learning in a science faculty

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A project for the dissemination of blended learning design in the faculty of Science used a successful foundational course in materials engineering, where online and face-to-face components were fully integrated, as an exemplar for similar developments in other science disciplines. The team-based process promoted academic development of online learning expertise, and the redeveloped courses now provide a model for blended learning in their respective disciplines, while the focus on benefit to student learning has resulted in significant improvements in student outcomes and experience in all the courses involved. This paper describes the transdisciplinary, collaborative, exemplar-based model used in the development process, investigates the impact on students and teachers of the course developments, and evaluates the effectiveness of the approach as a model for curriculum development and for academic development.

Keywords: blended learning, course design, development model, exemplar, interdisciplinary, transdisciplinary, academic development.

Background

Identifying practical strategies for effective integration of educational technologies into learning design and teaching practice in higher education is an ongoing issue. This paper describes and evaluates one approach taken at the University of New South Wales, a research-intensive and campus-focused institution, where most uptake of online learning is in the form of blended courses, either web-supported or web-dependent.

The design and development of online course components for blended learning is time consuming and costly (Brown & Votz, 2005; Tabata & Johnsrud, 2008). To ameliorate the costs, the conceptual design, structure and support material (scaffolding) embodied in an online course can be repurposed with relatively little effort for reuse in other courses (McAlpine & Allen, 2007; Oliver et al, 2002). Prior to the start of the work described here, this had already been done with success in a discipline-specific context where components from an exemplar course (in materials engineering) were incorporated with relative ease into several other courses in the same discipline. Based on this success, a broader project was undertaken to develop integrated blended learning courses across four different disciplines in science (maths, physics, chemistry and biology) using a blended learning design and online template derived from the exemplar course as a pedagogical framework and development model. Schools from the four disciplines were each asked to identify a course that would benefit from the introduction of online learning activities. The aims of the initiative were to improve the quality of teaching across the schools by the use of an exemplar course, and to improve student experience and outcomes by the development of online, student-centred activities. The project was designed to support the academics involved in designing and developing the required course components, and to enhance their skills and confidence in designing for online learning.

The project was undertaken over three years with a grant from the UNSW Strategic Priorities in Learning & Teaching initiative. This funded the employment of a dedicated education technology developer to assist the academics with the development of online materials. The focus of the project was on large-class foundation-course teaching as it was considered that the online environment is especially beneficial to learning in such classes, and a large number of students would benefit by taking learning skills and improved learning outcomes developed in these courses into their ongoing studies. This paper describes how the original course design was used both as an exemplar to inspire and inform review and redesign of courses in a range of different disciplines within science, and as an online template to support the development process. It goes on to evaluate the effectiveness of this approach as a model for curriculum development, and for academic development.

Considerations

Dissemination of effective innovations

In 2005, a study commissioned by the Carrick Institute (Dissemination, Adoption and Adaptation of Project Innovations in Higher Education, Mackenzie et al, 2005) made several recommendations for strategies to improve dissemination of innovation. These included (at an institutional level) to support with funding the adaptation and implementation of effective innovations, encouraging team-based projects that included academic development staff, and (at the project level) to support teachers to develop their skills and understanding in the relevant pedagogy, to encourage them to share practice, and to encourage a scholarly approach to teaching development. This project had achieved institutional funding to support dissemination. Considerations that arose in designing the project in line with these recommendations are discussed below.

Supporting technology integration in curriculum development

There is an identified need for the development of sustainable approaches to pedagogically effective online course design and development (O'Reilly, 2004; Tabata & Johnsrud, 2008). While there are descriptions of effective learning designs that incorporate technology (eg Oliver et al, 2002), the approaches described are not necessarily accessible to the time-poor teaching academic. These approaches may require considerable redesign of courses to incorporate, for instance, problem-based learning; they may propose technologies that the academic is unfamiliar and reluctant to experiment with; or the examples shown may pertain to a knowledge domain that is perceived as too different from the teacher's own disciplinary context or to a pedagogical approach at odds with the individual teacher's beliefs.

A plethora of available technologies have been reported to have the potential to enhance curriculum design in various ways: online communication and collaboration, interactive games and tutorials, simulations and visualisations, to name just a few (Laurillard, 2006). However, academics as course designers are often not familiar enough with the ways in which the technologies can be utilised efficiently, and do not have the technical skills to manage course development. Little wonder that teachers often see the introduction of learning technologies as an unacceptable addition to their workload (Steel & Levy, 2009; Tabata & Johnsrud, 2008). Any development strategy should ensure a sound pedagogical approach to curriculum design while improving efficiency for teachers, as well as enhancing student learning outcomes.

It has been shown that an effective model to overcome some of the barriers described above in supporting academics to enhance courses using technology is for a dedicated educational designer and developer to work alongside the teacher. This role may perform multiple functions (O'Reilly, 2004):

- project management: to keep the course redesign on track;
- theory expertise: to provide guidance with reference to current approaches in educational design theory;
- educational design: to provide specific advice about the appropriate educational design for the course context and required learning outcomes;
- provision of appropriate exemplars and models: to help the teacher conceptualise the design approach in their own teaching context;
- technical knowhow: providing expertise with learning management systems and other technologies for course building and resource creation, and assisting with emerging issues during course implementation; and
- evaluation: advising on and assisting in implementation of evaluation of the effectiveness of both learning design and technology use.

Appropriately managed, the process of course design and development in partnership with an educational designer can be productive as an academic development experience, and provide a model for the academic to frame future development work. However, O'Reilly (2004, 2008) has proposed that a transdisciplinary[1] team approach has distinct benefits over the one-on-one academic/educational designer model. She points out that online educational developments provide a context of common interest across disciplines, and that the academic development initiatives that educational designers are often responsible for or involved in provide opportunities to build on interdisciplinary discourse.

Supporting staff development in educational technology

It has long been suggested that ICT could hold the key to a paradigm shift in educational approaches for higher education (Duffy & Jonassen, 1992; Harasim, 2000), however 14 years after the development of the online LMS teaching approaches in higher education remain largely based on traditional models (Littlejohn, 2004). Effective pedagogical use of the technology is not yet systemic (Oliver, 2006; Conole & Fill, 2005) and universities have generally found that provision of technology has not necessarily been welcomed by teachers, let alone enthusiastically adopted (Steel & Levy, 2009). Previous studies have identified a range of institutional, cultural and personal barriers to uptake of technology in higher education (eg Lin, Singer & Ha, 2010; Steel & Levy, 2009; Tabata & Johnsrud, 2008).

Providing substantial educational technology design resources through recruiting dedicated support staff such as described above is costly, so a common approach to promoting use of technology in

[1] "Transdisciplinarity – the coordination of disciplines and interdisciplines with a set of common goals towards a common system purpose (from Jantsch, 1970, p.106)" O'Reilly, 2004, p725.

teaching in higher education is to ‘enable the teacher’, through provision by centralised learning and teaching (L&T) units of face-to-face workshops, online tutorials, and/or self-help resources (Littlejohn, 2004). By this means it is hoped that teachers will, with some effort, become proficient in all the aspects of educational design that we have described as the domain of an expert educational designer, even including expertise in technology development. Trailblazers in the field (teaching and technology enthusiasts who are committed to their role as teachers, and passionately interested in technology) are held up as exemplars, but ‘mainstream’ teachers do not necessarily share the character traits of ‘early-adopters’ that enabled them to be successful in teaching innovations (Barbaux, 2009) and, while inspiring, the idea that this level of commitment and expertise is a general expectation is off-putting to many teachers struggling to manage their teaching along with other academic expectations. Somewhat unexpectedly, a study by Tabata and Johnsrud (2008) indicates that institutional value placed on distance education acts as a disincentive for uptake of online teaching by academics, suggesting that motivation for engagement must be intrinsic. They also reported that teachers’ perceptions of their own technology competency (self-efficacy) seemed to be a critical element in both positive attitude toward and effective use of educational technology, and suggest that “experience might be the most persuasive tool in encouraging participation in distance education” (p 642). Littlejohn (2004) and Steel and Levy (2009) also suggest that affective aspects such as the teacher’s personal beliefs and conceptions of teaching and learning can form a significant barrier to technology adoption.

So, how can academics be encouraged to develop their own understanding and expertise in this area, while still having the benefit of expert support to enable them to embark on the risky business of enhancing their courses with technology? Incorporating critical reflection among peers could promote such personal development and understanding, and the supportive effect of working alongside peers with similar aims and problems could promote self-efficacy, while a team-based approach to development ensures the availability of the range of expert skills required (Oblinger and Hawkins, 2006; O’Reilly 2004, 2008). O’Reilly also promotes the involvement of ‘peak performers’[2] – academics already confident and successful in using technology – as having the potential for a powerful influence as exemplars and mentors.

The science domain

The issues encountered in the original materials engineering course are relevant to many disciplines in the science domain: large foundational classes of students who are not committed to the specific discipline, and a large amount of basic discipline knowledge to be communicated and assimilated. Common issues for disciplines across the university include: the development of generic skills such as communication and team-work skills, and improving the ability of students to apply learning in real-life contexts. However, the one issue that seemed to resonate most strongly with the project participants was that of ensuring student preparedness for on-campus classes such as laboratories, maximising the benefit of face-to-face class time.

There is a demonstrated usefulness of some specific technologies in science, with two main approaches identified:

- Visualisation of complex concepts, often in the form of animated or interactive learning objects (Ardac and Akaygun 2003; Talib, Matthews and Secombe 2005).
- Simulations, games and virtual environments allowing presentation of authentic situations in a safe, accessible and controllable mode. This includes virtual laboratories, where experiments that are too expensive or dangerous can be made available in a virtual space.

Design of the development approach

In light of the curriculum development and academic development issues discussed above, it was recognised that as well as providing an exemplar and template based on the original course, the development approach would need to support academics through a process of conceptualisation, design, development, implementation and evaluation. It was also seen as a benefit to introduce academics to scholarly aspects of teaching practice by discussing relevant educational theory, and encouraging them to regularly reflect on and provide a rationale for the design work they were

[2] Peak performers are described by O’Reilly (2004, p726) as: “early adopters in their universities, … who … found themselves mentoring and influencing others”

undertaking, and in this way an action research approach underpinned the process (Laurillard, 2008; O'Reilly, 2003, 2004). These considerations were embodied in an experiential learning framework, supporting an iterative design cycle: conceptualisation – action – reflection – revision (Kolb, 1984). This project did not expect the academic participants to develop substantial expertise in all aspects of the design and development process, so it was important that expertise be available within the team in the form of an educational design consultant, and a dedicated educational technology specialist. It was hoped however that by beginning with an exemplar and incorporating peer review in the development process that there would be a significant academic development aspect to the outcomes of the project.

The exemplar course and online template

The exemplar course had been developed over several years as a student-centred blended course design integrating online learning activities and assessments with traditional face-to-face learning environments. This first-year large-class foundation course in materials engineering had previously existed only in a face-to-face format. Key to its redevelopment was a team approach that drew on the expertise of both materials engineering academics and learning and teaching and web development specialists. The redesigned course has been extremely successful with student grades increasing by 15%, the failure rate decreasing by 75% and student numbers tripling from 250 to 750. Informal and formal surveys show that students find the course challenging and that they believe they have learned a lot. Elements of this course design have been reused in several other materials engineering courses. The structure of the exemplar course is shown in Figure 1, indicating the online course activities, and the elements that were generic enough to be easily reused. See Allen et al. (2009) for a more detailed account of the rationale behind the design of the exemplar course, and its outcomes.

There were two major design elements that it was believed could be relevant to other courses:

- A group project as a capstone assessment task, incorporating peer review and managed online. It was thought that the project design, as well as orientation and support material developed to assist groups in self-facilitation, could be reused in other subject areas with minimal customisation.
- Online tutorials and quizzes as pre-work for on-campus laboratory sessions. The tutorials contained animated and interactive graphical material to support conceptual understanding, and self-tests for formative assessment. While the educational design of the tutorials was transferable, the content is subject-specific.

The online template that had been created in the LMS (WebCT Vista at the time) contained the basic navigation structure of the original course, centred around learning activities, all the learning content that could be widely useful, and links to generic resources, eg for IT support and academic support on campus.

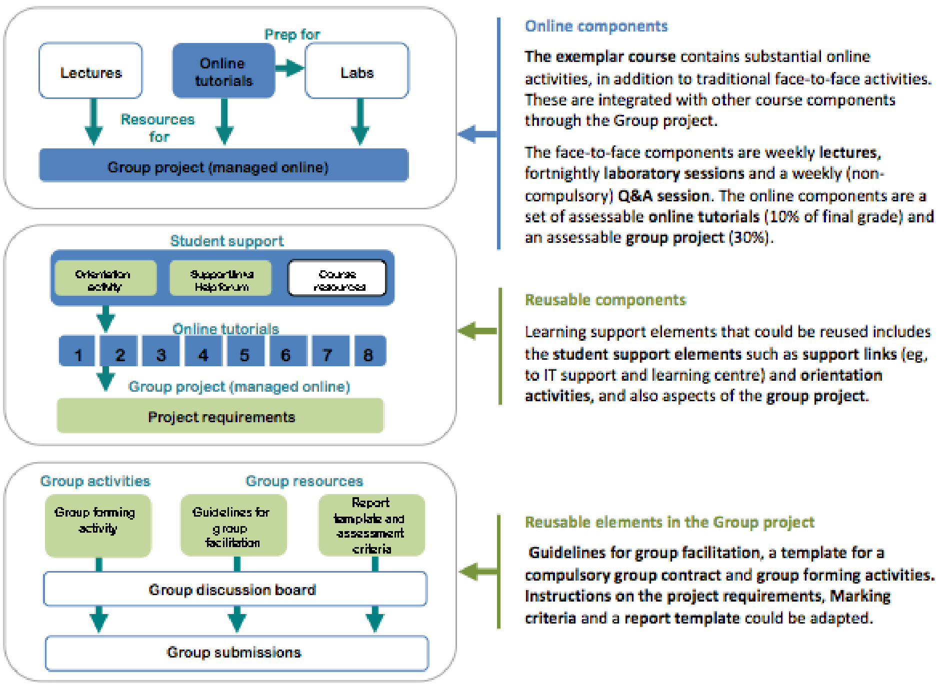

Figure 1: Outline of exemplar course, showing reusable components

Team-based development

The redevelopments were undertaken in a transdisciplinary team-based approach as suggested by O'Reilly (2004), which promoted cross-fertilisation of learning and teaching approaches, and ensured that peer review, evaluation and reflection were integral to the process.

The process was iterative and design-oriented as described above. The development cycle was to:

- identify existing student learning issues through a needs analysis based on student feedback and learning outcomes,
- to design integrated course elements to address those needs, promoting the development of graduate attributes such as independent learning and technology skills,
- to redevelop the courses into coherent blended courses by introducing online resources and activities based on, or inspired by, the exemplar course,
- to implement and evaluate the redeveloped course.

The project leader was the academic responsible for the exemplar course, and was supported by an educational design consultant who had worked on that course development. The project employed an educational technology developer to assist with project management as well as working with individual academics on their course design and development. There were four academics representing four schools from the Science faculty (Maths, Physics, Chemistry and Biology). This team of seven met monthly to discuss and review the design and development process. Additionally, faculty staff concerned with learning and teaching (eg learning and teaching co-ordinator, Associate Dean Education), library staff, and ancillary teaching staff were occasional attendees.

The academic project leader (a 'peak performer') acted as an exemplar and mentor, the educational design consultant focused review meetings on pedagogical rationale, and the educational developer facilitated building the courses based on the online template, and the design and development of customised learning resources which could convey complex concepts, extending the basic functionality of the LMS which may be experienced by academics as a barrier to realising pedagogical aims (Steel & Levy, 2009)

The development process

The courses redeveloped were in the schools of physics, biology, maths and chemistry. Like the exemplar course, the first three of these courses were large-class foundation courses taken by students outside the discipline. It was useful for comparison purposes to include a more advanced discipline-specific course and the third-year chemistry course was selected on this basis. The development process for each course was:

- analysis of course curriculum, structure, teaching practices and learning outcomes, and identification of current learning and administrative challenges.
- design of a blended learning environment that addresses the identified issues and integrates existing course content and resources with attention to the design of student workflows that provide logical and natural transitions between online and face to face components.
- development of the learning environment by adapting existing course designs and resources, and building new resources including simulations, diagnostic tests, online flowcharts and online assessment modules.
- implementation of the course via the centralised LMS (initially WebCT Vista, migrated to Blackboard Learn)
- evaluation of the redesigned course elements to inform further refinement.

The development process occurred concurrently with regular team review meetings, as shown in Figure 2. The initial meetings were concerned with deconstructing the exemplar course, discussing the design rationale, and demonstrating the online template and generic course elements available for reuse. Each participant then described the course they were redeveloping, and their aims for the project. Between the monthly meetings, individual project meetings were held with the educational developer to provide specific design and development support.

While the same process was used for all the courses, it emerged that the needs of the individual courses, while similar to a degree, varied so that a range of different design solutions were adopted. In the end, while elements of the exemplar course were inspiring, the online template with the reusable course resources was not particularly useful as the design solutions required their own customised resource development. In three of the four courses, some form of preparatory online activity was included, sometimes requiring the development of animated and interactive components, while in the fourth course, self-paced learning modules to teach discipline-based software were developed. Unlike the exemplar course, assessment design was not transformed, but enhanced and supported by the new online elements. Details of the development and outcomes of each of these courses are given below.

The different courses arrived at different stages of development at different times, and the project as a whole ran over three years, 2007-2010, with the first course implementation occurring in 2008, the last in 2010. During this period a change in the central LMS from WebCT Vista to Blackboard necessitated some redesign to successfully migrate course developments, drawing somewhat on the original project resources.

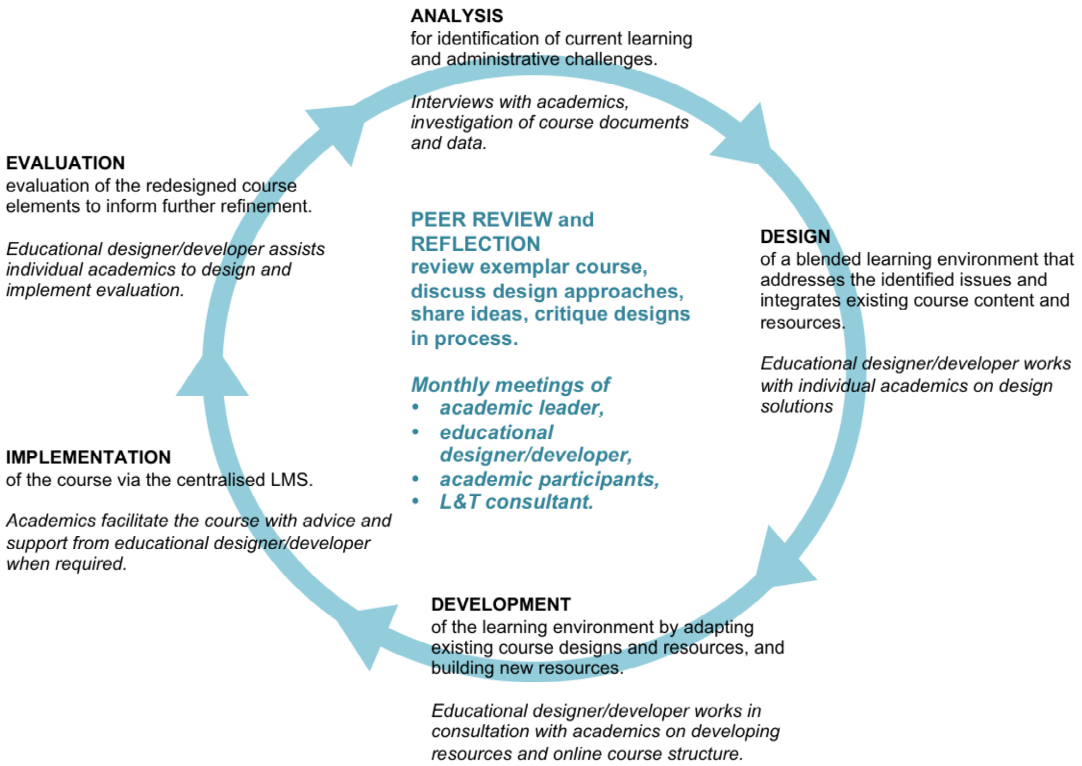

Figure 2: The development process

Course redevelopment descriptions and outcomes

PHYS1111 Fundamentals of Physics

(200+ students) A first year foundation course taught to non-continuing students with no background in physics.

Learning issues identified through course evaluations, demonstrator focus groups and instructor observations were:

- Difficulties understanding physics concepts and perception that course is too difficult
- Inadequate preparation for laboratory classes
- Lack of student engagement
- Logistics of having large numbers of students with limited staff and material resources
- Inconsistency of instructional quality, feedback and marking in laboratory classes
- Perception of inadequate laboratory time and opportunities for reflective learning.

Design solution

The pre-existing manual-based pre-lab exercises were redesigned into assessable interactive online modules. Each lab unit belongs to a larger knowledge area and forms one learning module including:

- Online pre-lab exercises containing cartoons, interactive activities and formative questions designed to introduce basic concepts in a way that's accessible to novices while illustrating links between visible phenomena and diagrammatic and formulaic modelling.
- A short computer-marked online summative quiz to test understanding. Computer marking replaces demonstrator marking of pre-lab work, freeing up more demonstrator time for instruction, and improving marking consistency. Marks are awarded to encourage completion, but students are able to take the quiz up to 3 times, as the emphasis is on developing a good theoretical understanding prior to laboratory work.
- Lab experimental work.

Each module contains a number of learning activities, with several opportunities for students to test their knowledge.

Evaluation/student feedback (2008-2010)

- Student failure rate - reduced from 18.5% to 8.6% of cohort
- Average (mean) student grade – improved from 58.5% to 73.4%
- Student confidence in understanding theory up from 30% to 68% of survey respondents
- Satisfaction with lab manual up from 32% to 83%
- Perception of adequate time for experimentation – up from 19% to 77%

Comments

- Online resources & pre-lab test really helped me in understanding.
- Online activities were easily accessible and convenient
- They were interactive and allowed us to experiment with different scenarios
- Best thing about the online course was instant feedback
- The online exercises were really good as they provided examples.

Further details of the course redevelopment are given in Yench et al, 2008 and Wilk and Yench, 2009.

BIOC2291 Fundamentals of Molecular Biology

(100+ students) - A second year course for students that do not intend to continue study in the area.

Learning issues identified by an analysis of student laboratory report assessment tasks which found:

- Students had difficulties connecting laboratory experiment practical work with presentation of fundamental concepts in lectures and tutorials
- Students had difficulty producing, presenting and interpreting data accurately.

Design solution

- Course restructured into topic areas so that all content is organised online by knowledge area to better integrate the individual learning activities for each topic.
- Interactive, animated online virtual experiments were developed as companions to the existing hands-on labs. These were designed specifically to make conceptual linkages between observed scientific phenomena and experimental data explicit and to model correct presentation and interpretation of data.

Evaluation/student feedback (2008-2009)

- Increase in proportion of students able to process data correctly into a meaningful form using correct units - 80%
- Increase in proportion of students able to present their data correctly and clearly in a graphical form -24%
- Agreed (SA+A) that online module assisted in conceptualisation of experiment - 87%
- Agreed (SA+A) that online module explains how theory relates to phenomenon observed in lab - 92%

More detailed accounts of the redevelopment are given in Lebard and Quinnell, 2008 and Lebard and Yench, 2009.

MATH1131 Mathematics 1A

(1300+ students S1, 400+ students S2) - A first year foundation course in mathematics offered to students in a wide range of disciplines. The course includes an online introduction to the mathematics software Maple which students are required to use in later discipline-specific courses.

Learning issues identified by course instructors based on course evaluations were:

- Students do not see relevance of learning Maple and feel it is not integral to the course, preferring it to be delivered as part of lecture content rather than as self-directed online modules.
- Maple-related content within the course structure is plentiful but scattered and can be difficult to find.
- Computing environment for students in MATH1131 is Linux based rather than a commercially available product. The combination of a new graphical interface together with Maple, a very sophisticated and unforgiving piece of mathematical software, could place a high cognitive load on students as they attempt to focus on the required aspects of Maple and the course curriculum.

Design solution

- Pre-existing Maple instruction sheets were developed into a series of seven online learning modules.
- Modules were built which integrated existing instruction sheets with clear learning objectives, relevant practice exercises, recaps and summaries, and links to relevant resources – these explicitly draw links to course curriculum through the development of simple exercises that bring together the Maple content and the other course content.
- Lecture notes also explicitly refer students to Maple for relevant exercises.
- Quizzes in Maple TA are linked to each module, and can be done an unlimited number of times. Sequential quiz release forces sequential working through the modules.
- The course outline and content structure of the online course was reorganised to emphasise the Maple computing component as a curriculum area along with algebra and calculus, rather than as an administrative task.
- Orientation videos have been developed to assist students with the Linux graphical interface in the maths labs.

Evaluation/student feedback

- % of class taking online Maple test increased from 81.5% to 96.9%
- % of class taking laboratory Maple test increased from 90.1% to 93.6%
- overall average grade for computing component increased from 71% to 72%
- Over 80% of students agreed that the online modules improved their understanding of Maple concepts, and that they were confident in completing the Maple lab test.
- 69% of students believed the online Maple tests were an effective learning tool.

Comments

What students liked best about the online learning activities:

- it helps us to review what we learned and consolidate our knowledge; always available; it is easy to access, very convenient; I can understand how to use maple much better...; easy to follow and self paced; the ability to interactively puzzle out the answers and obtain feedback

A more detailed account of the course redevelopment is given in Blennerhassett et al, 2009.

CHEM3041 Analytical Chemistry

(~ 35 students) - An advanced course in analytical chemistry taken by third year students majoring in chemistry.

Learning issues identified by course evaluation surveys and feedback from lab instructors were:

- Lab manual instructions were unclear
- Marking scheme for lab reports was inadequate and not transparent to students
- Purpose of pre-lab exercises was unclear
- Students were frequently not prepared for labs, with potential impact on safety (OHS, pre-lab missing)
- Quality of post-lab reports was low, especially data analysis.

Design solution

- Online learning module provided for each laboratory exercise containing pre-lab work, risk assessment (OHS) and post-lab report submission.
- Detailed marking scheme generated
- Templates provided for reports
- Experiment on data analysis introduced

Evaluation/student feedback (2008-9)

- Student satisfaction with pre-lab exercises – increased from 34% to 56%
- Student satisfaction with report guidelines – increased from 33% to 69%
- Student satisfaction with lab organisation– increased from 63% to 91%
- Student satisfaction with laboratory experience– increased from 63% to 87%
- Students found to be better prepared (especially OHS)
- Quality of reports found to be better (especially data analysis)

A more detailed account of the course redevelopment is given in Thordarson et al, 2009.

The bottom line

For teachers

Teacher interviews and a brief survey followed the project to determine how they perceived the project outcomes. The following is based on the responses of three participants; one participant was on leave and unavailable for interview.

The exemplar course and online template
Teachers have reported that the exemplar was inspiring in helping them to conceptualise and design their course developments. The course design itself provided ideas, and the fact that it had proven successful encouraged the other teachers to take risks in implementing technology themselves. Discussion at the group meetings of problems and issues around the online design and implementation of the exemplar course were also seen as very useful.

The final course designs all differed substantially from the template, and the generic material provided mostly related to the group project, which was not included in the other designs. The reuse of online components was therefore not significant, although they had been reused successfully within the original discipline. In all cases the effort required to do the redevelopment was greater than anticipated, however, the new developments have in some cases been able to be reused or adapted in their home discipline. From this experience, it is clear that the conceptual rather than the technical framework was the more effective enabler.

The influence of the academic responsible for the exemplar course was particularly powerful, in providing a model of successful course design and implementation, and as a 'peak performer' whose opinions were valued on the basis of his successful experience. He also provided an effective model on the advantages of collaborative practice for course development, and how successful practice (and otherwise!) can be shared with peers:

The team-based development approach
All participants agreed that the team meetings were very useful in helping them to define and refine their approach. The cross-discipline nature of the team allowed free discussion, and brought new perspectives, although this sometimes meant that the discussion was not as relevant as it might have been with participants from the same discipline. It seems that it is not common practice to share teaching design and practice within schools, unless it is in the context of a formal review, so this opportunity was appreciated. The participation of an educational design consultant assisted in focusing discourse on pedagogical rather than technical aspects of the development. All participants indicated that they would now prefer to work in a team for course developments, and that they would recommend this approach to their colleagues.

Educational development support
Unsurprisingly, all participants agreed that the availability of the educational developer was critical in achieving their aims in the development. Two of the participants had done their own technical development work, but relied on the project developer to assist with project management, consult on

educational design, and as support during the implementation and evaluation phases of the course - this was still seen as a critically important contribution.

Academic development

Most teachers reported that they now feel more confident in using technology, and are now more likely to share their learning and teaching ideas with their colleagues. Respondents strongly agreed that they finished the project with a better understanding of educational design for online learning. In one case it was the academic's first real contact with educational design and "allowed me to fully understand the structure of the entire process of online learning".

Dissemination

In all cases the course developments have been positively received in the school, and are either being used as a model in other courses, or there is an intention to do so. Where the course content is not directly reusable, it may be customisable, or provides a design model, for other courses. In this way the exemplar-based approach has had a positive effect in promoting this approach within each discipline.

The academics involved had not been engaged in the scholarship of teaching, and their prime motivator in participating in the project was to meet with like-minded peers and to have support for their course developments that would not otherwise have been available. The level of engagement with theoretical aspects of the course development process was variable. However, in most cases there is an intention to publish on the process and outcomes of the course development, or this has already been done, in collaboration with project staff, or faculty L&T staff (see references in Appendix 1). Again, for most participants this was the first time they had felt confident to publish on their teaching practice.

For students

After redevelopment, evaluation of all four courses showed substantial improvements to student engagement and learning outcomes. Student feedback indicated that students generally appreciated the online elements, and felt they had a positive influence on their learning. Notably, students commented that they appreciated the effort that had gone into developing the online resources, and when asked what additional online activities or resources would support their learning, requested more of the same – interactive exercises and examples, self-tests, demonstrations and animations.
The improvement in student outcomes is not unexpected in the light of the efforts that went into course improvements. It could be of interest to gauge student perception of their teachers' confidence and ability in using technology after this development process, although this has not been done in the current study.

Questions and conclusions

Was the development process effective? In improving learning outcomes and learning experience for students, there is evidence of effectiveness. As an academic development strategy, there have clearly been benefits for teachers from most aspects of the project: the transdisciplinary team-based approach, the exemplar course, the leadership of a 'peak performer', and the availability of education design/development support. Broader impact of the project has already been seen in dissemination of the course developments by publication and use of the developments as course design exemplars.

While there has been benefit both for curriculum development and academic development, is this strategy efficient and sustainable? Considerable time was given to the project by the academic leader and the L&T consultant, and funding was needed to provide the dedicated educational developer, who was a critical member of the team, without whom these positive outcomes would not have been possible. Now that this (funded) stage of the project has come to a close, what is the potential for continuing the work? The academics involved have all been very positive about the development process, but their continued involvement would not be likely unless they are embarking on additional course developments. They would recommend the process to colleagues, but how motivated would those colleagues be to get involved without the funded support of a dedicated educational developer? It is hoped that the experience of the participant academics will impact on their future educational development work, and influence their peers, but this has yet to be evaluated.

It must be acknowledged at this point that while this approach was an effective model for development at the individual course level, it was not a solution for problems such as the cost of resourcing the expertise needed for pedagogically sound educational technology development, or of systematising effective innovation. While continuing group meetings around educational developments could be an effective way to keep pedagogical concerns to the fore in course-level technology initiatives, in this instance it relied heavily on the goodwill and enthusiasm of an academic leader who already has a full teaching and research load. For this to be sustainable some form of incentive such as teaching relief could help to encourage the involvement of 'peak performers' as L&T leaders. A useful way forward in formalising such developments could be for faculty L&T leaders to consider this model in institutional and faculty initiatives to involve academic staff at program design level.

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