Educational Research for Social Change (ERSC)
Volume: 2 no. 1, April 2013
pp. 98-116
ersc.nmmu.ac.za
ISSN: 2221-4070

Exploring Flexible e-Learning Options in a Postgraduate Project Management Course

Claire Donald and Garry Miller

University of Auckland, New Zealand

c.donald@auckland.ac.nz

Abstract

An e-learning development project has recently been piloted in a taught postgraduate course in the Faculty of Engineering at The University of Auckland, New Zealand. This paper describes the first stage of course design, the collaborative development approach, and early results of the project from the perspectives of the teaching team and the learning designers. We interpret these results using dimensions of "teaching presence" derived from the Community of Inquiry (CoI) framework. This yields a rich portrayal of the educational change processes involved when integrating e-learning in tertiary teaching. The main finding was that the process of innovating, and the introduction of flexible learning opportunities, led to increased student engagement, sometimes in unexpected ways but with positive learning outcomes. These results inform current planning and development of further e-learning initiatives for this and other courses in the Master of Engineering Studies programme. The findings may be generalised to similar postgraduate courses in professional, applied disciplines (such as Business) where flexible or distance learning supports the up-skilling of professionals in industry.

Keywords: Flexible Learning; e-Learning; ICT; Project Management; Postgraduate Engineering Education.

Introduction

Information and communication technologies (ICTs) that support teaching, learning, and assessment are being integrated into educational settings on an increasing scale world-wide at all levels of educational systems, from pre-school to tertiary and continuing adult education (De Cicco & Kennedy, 2012), 2012). Despite the digital divide that often exists, substantial economic investment is being made in ICTs to support social development and educational reform in many countries (Kozma, 2005). The wider access to low cost communication technologies (e.g., mobile devices, cloud computing, and wireless networks) has

led to an ever-diversifying range of ICTs being available to educators and students. In tertiary education this increase in availability and diversity of ICTs is changing the expectations of educators and students alike for how degree programmes are taught and how students participate as learners—as is evident in the way social networks, Web 2.0 tools, and open educational resources are being used in open education to offer massive open online courses (MOOCs) to thousands of tertiary students globally (Daniel, 2012).

This paper reports on the experience of adopting an innovative approach to teaching experienced and professional engineers using new ICTs in a postgraduate course on project management. Several studies of ICTs in engineering education have focussed on using ICTs to provide learning opportunities or resources that match students' learning styles (for example, Patterson, 2011; Mohd & Aziah, 2012) However, we explore issues of what ICT innovations best supported, and had the maximum desired impact on, learning outcomes; how we matched pedagogical requirements and technological affordances within a specific educational context; and how selected theoretical frameworks for ICT integration informed a productive interdisciplinary teaching partnership.

The results signal more fundamental implications for change in educational practice and approaches when integrating ICTs in tertiary teaching. These relate to "openness" of access to courses (Conole, 2012; Marshall, 2011), and to academic teachers' willingness to "open" their places and spaces of teaching, to recording and tracking technologies, to bridging inter-disciplinary boundaries, and to adopting iterative approaches to review and redevelop teaching resources and methods in response to student and collegial feedback. As Bates (2005) points out, successful e-learning initiatives in higher education demand organisational and cultural shifts to enable the nature and scale of the changes in teaching practice such as those reported here.

We conclude with outlining future research and development plans for this project and suggest wider implications for educational change, particularly in online teaching and leadership roles, when ICTs are integrated in higher education.

Background

Description of the Masters of Engineering Studies programme

Since its inception the Master of Engineering Studies (MEngSt) programme (Construction Management specialisation) has been offered on campus only. This taught programme attracts students typically with 3–10 years or more of industrial experience who are looking to return to university to undertake advanced level studies as part of their career progression planning. A significant portion of students on the programme are enrolled part-time. A recent review of the programme recommended adding flexible learning options for students who wish to study from a distance or who cannot attend all lectures and labs owing to work commitments. This aligns with two elements of the University of Auckland's current Strategic Plan: one, which advocates increasing the proportion of students enrolled in taught postgraduate programmes, and the second, which calls for innovative and advanced use of ICTs for teaching, learning, and research (University of Auckland, 2012). As a first stage in responding to this recommendation, one of the Project Management courses from the programme was selected to trial the development of more flexible learning options.

This course was seen as successful and vibrant by an independent panel of reviewers because it provided students with in-depth knowledge of the discipline of construction management as it applies to the modern construction industry. It attracted significant numbers of students taking the course as an elective within the department, as well as attracting students from other departments and faculties. Student cohorts of approximately 100 students are typically diverse in terms of background discipline, industry experience,

prior qualifications, maturity, and whether they are full-time or part-time. Ultimately the programme needs to cater for different student cohort profiles: full-time or part-time, and on-campus or distance. Students would benefit from being able to move from one cohort to the other if, for example, they needed to move away for work while enrolled on the programme.

Aim of the Teaching Innovation Project

This project forms part of a larger strategy involving ongoing development of online flexible learning options for a greater proportion of the compulsory and elective courses on the MEngSt programme. There was thus a commitment by the lecturer and course designers to:

- Increase flexibility for part-time and distance students by integrating ICTs into the teaching and course materials
- Use this project as a trial for further ICT and e-learning integration in other postgraduate engineering and business courses
- Adopt a research-based approach using peer review and formative evaluation of specific features of the course in collaboration with colleagues (teachers, engineers, and learning designers) at each stage of development.

The next section expands on each of these aims.

Project Approach

Prompted by the drivers for change as outlined above, the course lecturer (also the programme coordinator) approached learning designers in the University of Auckland's Centre for Learning and Research in Higher Education for advice on best practice in e-learning and flexible course delivery. A number of consultations ensued when objectives were clarified, and other local and international examples of online and blended courses were reviewed that had similar teaching and learning requirements. An initial project brief was drawn up by the course coordinator, which included the ICTs he wished to trial in the initial phase of development.

A design research approach (Reeves, Herrington, & Oliver, 2005) was proposed by the learning designer so that socially responsible methods of inquiry would be used to enhance the quality of the research. Using this approach, rich data is collected during cycles of collaborative planning, design, development, implementation, observation, and reflection on the new teaching strategies and learning tasks. The data is analysed after each cycle in the light of established educational theory. This paper reports the first course design and development cycle within this overarching design research approach.

The e-Learning Project: The First Design and Development Cycle

Brief Description of Project Management Course: delivery and assessment

Prior to this pilot project, the lecturer offered a weekly two-hour lecture, one two-hour tutorial or lab per semester on industry software, and office hours for student consultations on two afternoons per week. The university's Learning Management System (LMS) was used to make course announcements and to provide lecture notes and presentations, assignments, and readings online. Assessment was by means of four discussion papers (essays) and two individual assignments which involved applying principles learned in the work place, or in relation to hypothetical cases. There was no final exam.

The overall objective of the new course design is to provide flexible access and additional online learning opportunities for on-campus, part-time, and, in the future, distance students. This blended approach seeks to "integrate[s] online with traditional face-to-face class activities in a planned, pedagogically valuable manner" (Picciano, 2011, p. 4). Hence, a course website was developed in the first instance as the main component of the design and development cycle. Over a period of four weeks the lecturer developed the course website using CourseBuilder[1]. The course website was designed to be used in conjunction with the university's Learning Management System (LMS), supplementing the LMS functions such as course announcements, grades, assessment, and so forth. The website features were structured according to the course topics using a simple matrix approach, shown in Table 1.

Table 1

Structure and features of the project management (PM) course website according to topics

Provide on the website:	Lecture slides and handout notes	Lecture recording	Weekly case study	Multiple-choice self test	PM templates	Assignment discussion paper	Assignment Question and Answer Forum
Topic 1: Introduction	●	●	●	●	●		
Topic 2:	●	●	●	●	●		
Topic 3:	●	●	●	●	●		
Topic 4: etc	●	●	●	●	●		
Assignments 1 & 2						●	●
Discussion papers 1–4						●	●

The intended student learning outcomes were reviewed at the outset of the pilot and were not changed. The linkages between these learning outcomes and the e-learning approaches adopted for the pilot are presented in Table 2.

[1] CourseBuilder: http://www.clear.auckland.ac.nz/index.php?p=coursebuilder is a course website development tool created at the University of Auckland that requires no coding or html knowledge. It is specifically for teachers who wish to develop educational websites and offers a wide range of powerful interactive, collaborative, and multimedia features designed for teaching and learning contexts.

Table 2

Links between intended learning outcomes and e-learning features used in the pilot

Intended learning outcome	e-Learning features	Linkage between learning outcome and e-learning feature
Understand the fundamentals of project management.	Course website Case studies Multiple-choice self tests Q&A Forum Lecture recordings	Explicit conceptual linkage by providing richer content.
Identify and manage the factors that influence the successful outcomes of projects.	Online case studies with threaded discussion forum	Implicit by providing weekly case studies exploring different success factors. Case studies discussed online and in class.
Be able to analyse and assess the project management needs of organisations.	Website Project management templates	Implicit by demonstrating how templates can be used within an organisational framework.
Understand and apply a range of project management theories, approaches, tools, and techniques.	Website Online case studies Project management templates Lynda.com training videos Lecture recordings	Explicit by introducing a wider range of theories, approaches, tools, and techniques. Students' project management templates were uploaded to supplement those provided by the lecturer.
Undertake the role of the Project Manager.	All: the pilot itself Q&A Forum on assignments	Implicit by presenting the pilot to students as a project.

The introduction of e-learning gave us an opportunity to review and enhance the course assignments. Whilst the means of assessment and the structure of the assignments were unchanged (i.e., two major assignments, four minor assignments, no exam), the ICT technologies opened new options for more imaginative content for the assignments. For example, assignments were designed around further analysis of the online case studies, templates were developed to suit organisational project management needs, and tools and techniques were applied to project management scenarios. We also modified one of the major assignments to a virtual team-based project, and provided an online forum for each team to help facilitate collaboration between students.

Other e-learning features available to students were:

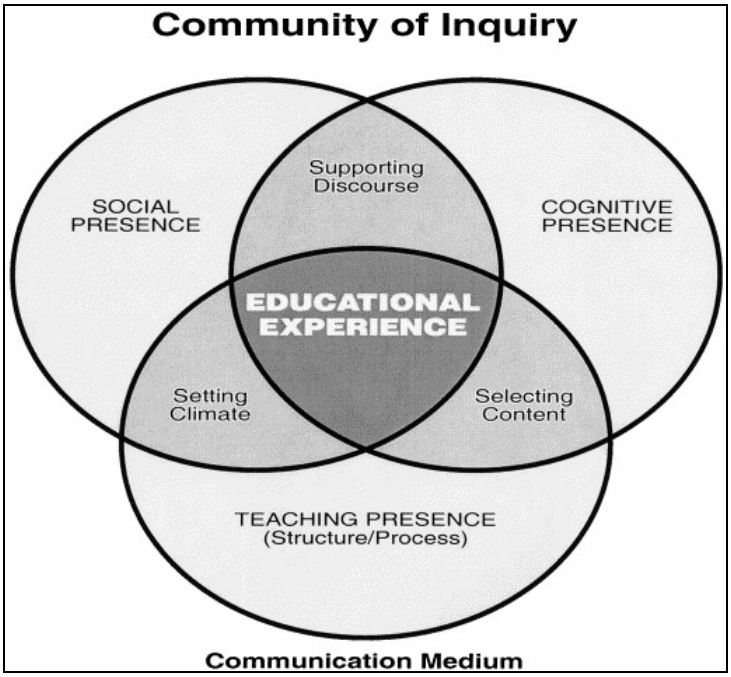
- Online office hours, where students could make appointments for meetings online, with options to hold online meetings via video conferencing (using Skype).
- Lecture recordings, which were made available after each lecture and remained so for the duration of the semester.
- Online training videos on Microsoft Project from Lynda.com**.** These were used on a trial basis as additional flexible learning resources for students who were unable to attend class tutorials on the software.

The first implementation: Monitoring and managing "teaching presence" of the new blended course

For this first implementation of the blended course, we monitored "teaching presence", proposed by Garrison, Anderson, and Archer (1999) as one of three elements of the Community of Inquiry (CoI) framework. This framework, illustrated in Figure 1, proposes that teaching presence, social presence, and cognitive presence are critical to sustain a collaborative and worthwhile educational experience in a community of inquiry (Garrison, Anderson & Archer, 2010). While the framework was developed in the context of asynchronous, online, text-based group discussions, it offers a useful way to examine teaching practice in a blended e-learning environment that is not fully online. During the second course design and development cycle, our research focus will expand to include the social and cognitive presences of this framework.

Figure 1.

The Community of Inquiry framework (Garrison et al., 1999, 2010)



Teaching presence is defined as "the design, facilitation and direction of cognitive and social processes for the purposes of realising personally meaningful and educationally worthwhile learning outcomes" (Anderson, Rourke, Garrison, & Archer, 2001, p. 5). We now address these three dimensions of design, facilitation and direction in the following section of this paper. Thereafter we provide reflections, conclusions, and recommendations.

Design *as a dimension of teaching presence*

It has been suggested that teaching presence is continuous from design to implementation and evaluation when integrating e-learning within a course (Philip & Nicholls, 2007). This was our experience with the project management course.

The design dimension of teaching presence required not only a substantial increase in the number of new ICTs used in the course, but a growing, dynamic understanding of how to best adapt and use these to

support teaching and learning in the context of this course. The new and existing ICTs used during the first implementation of the blended course are listed in Table 3.

Table 3

Comparison of ICTs used before and during the blended project management course

ICT's used in previous years	New ICT's used in the 1st Design and Development Cycle:	
	Prepared prior to first day of teaching	Adapted and maintained by the lecturer during teaching semester
Learning management system (LMS) for: • Announcements • Grades • Lecture notes • Slide presentations • Assignments • Readings online	Learning management system (LMS) for: • Lecture notes • Slide presentations • Assignments • Readings online	Learning management system (LMS) for: • Announcements • Grades
Microsoft Project	Microsoft Project	
Microsoft PowerPoint presentations	Microsoft PowerPoint presentations	
	New course website developed and populated with: • Case studies • Project management templates • Self-test multiple-choice questions and answers on each topic Lynda.com training videos	Course website regularly updated to include or update: • Lecture theatre recordings • The Q&A Forum • Project management templates • Weekly online competition for best contribution from students Online office hours with videoconferencing (using Skype)

Each new ICT, with its own educational affordances, was used to support student learning differently; mapping affordances to learning requirements (Conole, Dyke, Oliver, & Seale, 2004). Sometimes this involved preparing resources ahead of the course which remained largely unchanged while teaching (e.g., readings, case studies, assignments, slide presentations), while other tools and resources were updated and maintained continuously (e.g., forums, templates, lecture recordings). This required a reflective and proactive approach open to taking risks and accepting critique from students and colleagues.

There were other potential risks inherent in taking an innovative teaching approach that involved integrating new ICTs: risks of using relatively unfamiliar software to deliver core teaching material; risks of unexpected student responses to using new software and user-interfaces; risks of negative student evaluations; risks of lowered student attendance at lectures due to the availability of lecture recordings; risks of unforeseen technical failure, or incompatibilities; and risks of peer criticism from colleagues in the teaching department. While these risks were real, we actively mitigated them by: consulting with experienced learning designers; learning from examining other online courses (case studies); being responsive to students and making a concerted effort to obtain large amounts of informal feedback; undertaking training in the new ICT systems; having a sense of fun and not taking self too seriously when technical glitches occurred; and accepting constructive criticism from colleagues as part of the ongoing process of improvement.

Facilitation *as a dimension of teaching presence*

While the design emphasis is on course and resource presentation and structure, and mapping ICT affordances to learning requirements, facilitation focuses our attention on the learning experience as a process of inquiry; guiding student learning from perception to conception, between theory and practice,

through deliberation and application of the course concepts (Garrison et al., 1999). Facilitation as teaching presence in this course involved maintaining an online presence through making regular updates to the course website before and during the teaching semester, moderating the Question and Answer (Q&A) Forum, and incorporating student contributions to the course content. We anticipated that the ongoing development of the website would become one of the features of the course, enabling the lecturer to interact with students in more meaningful ways than a static website would allow.

We monitored student participation in the new course website on a daily basis, particularly the Q&A Forum for answering student queries. It was important that questions were answered within 24 hours with a considered response. This proved to be a successful strategy; whilst it demanded some rigour to set time aside every day, it helped reduce the number of students coming to the office asking similar questions (See Table 4). The lecturer still maintained office hours, with an online booking system for half-hour slots. However these slots for office appointments were not used for routine queries as most of the straightforward questions were dealt with via the Q&A Forum, freeing time for more purposeful teaching activities and increasing the productivity of staff and students.

Table 4

Usage of the online Question and Answer (Q&A) Forum in relation to assignment deadlines

Assignment	Percentage of the course assessment	Deadline	Number of queries posted via the Forum
1	5	Week 4	11
2	5	Week 4	5
3	40	Week 6	51
4	5	Week 9	21
5	5	Week 9	2
6	40	Week 12	6

Incorporating students' contributions to the content of the course was the third component of facilitation as teaching presence. As noted earlier, many of the students were professional engineers with years of industry experience; they had valuable experience and practical examples to contribute. Experimenting with principles of the "contributing student pedagogy" described by Hamer et al. (2008), we invited students to share their experiences wherever possible in the application of project management theory to practice. Examples included addition of resources to the course website, addition of quotations on project management sourced by students, and posting of templates and other materials that students developed.

Direction *as a dimension of teaching presence*

Direction in Garrison et al.'s (1999) CoI framework refers to direct instruction and how this engages social and cognitive presence by learning communities in online asynchronous forums. In the context of the project management blended course, this dimension of the lecturer's teaching presence focuses our analysis on the influence of lecture recordings for the first time in this course. Research on the impact of lecture recordings on teaching and student learning shows that, contrary to expectations, the availability of lecture recordings encourages students to attend lectures rather than miss the lectures and use the recordings as a replacement (Gosper et al., 2008).

At the outset we anticipated that lecture recordings would be more useful for some student cohorts than others, particularly for those working part-time who may not have been able to attend all lectures, or students studying via distance learning. Whilst we wished to enhance the flexibility of the course via the use of lecture recordings, we also took the view that the quality of the lectures was paramount, and that the use of recordings should not detract from the experience in class. The University of Auckland guidelines for staff on using lecture recordings advises that recordings are useful when:

- The lecture is delivered in a traditional format based on one-way communication
- Class sizes are large and tend to be impersonal
- There are little or no interactive elements where students communicate or collaborate with others.

These features are contrary to our preferred style of conducting lectures where class discussions, facilitated interactions, and group work are regular features. We therefore split the two-hour lecture in two with a formal presentation in the first hour, and student interaction and participation in the second. We recorded the first hour of the lectures, and arranged for the recordings to be posted on the website within 24 hours.

Overall, the approach appears to work well for this particular course. It took two or three lectures to become comfortable with being recorded, but thereafter the recording process did not affect the lecture. Students in the project management course were very positive about the lecture recordings and reported that they were useful for revision and clarification and, in some cases, for catching up when they had missed a lecture. Although we didn't count class attendance, there was no noticeable reduction in the number of students attending classes compared to previous years—indicating that the lecture recording supplemented the course rather than replaced traditional lectures. Whilst our findings on this are rather subjective, we plan to collect more objective feedback and data in future years. We outline our research design for the next iteration later in this paper.

Reflections on the First Design and Development Implementation Cycle

Most of our reflections on this first cycle are qualitative, based on observations, critical self-assessment, and informal feedback from students. We also reviewed student satisfaction scores available for the course at the end of the teaching semester, and website usage data.

Student satisfaction results

The University of Auckland collects feedback from students as a routine part of quality assurance procedures. Results of student satisfaction surveys for the past three years are summarised in Table 5.

Table 5

Student Satisfaction Results

Course Title	Feedback Score (Grading scale 0–10)		
	Year 1	Year 2	Year 3 (when the blended course was first piloted)
Project Management	7.2	7.9	8.4

Note: Students rate positively-worded statements on a scale of 0–10 (0 = strongly disagree, 10 = strongly agree).

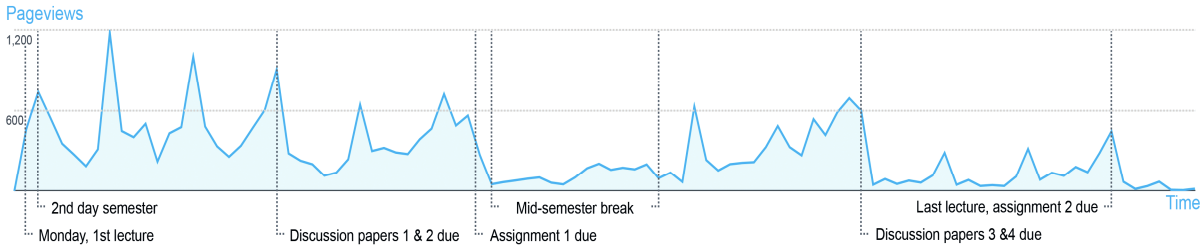
The target was to obtain a feedback score of 9 or better. Whilst this was not achieved there was an improvement compared to previous years. We acknowledge that these results only provide indicative feedback because there are numerous other factors that account for the improvement in satisfaction results, and there is insufficient data to draw any statistical relevance.

Website usage data

During this first implementation of the blended course we monitored usage data for the new website using Google Analytics. Figure 2 shows that in the first half of the semester website use was high, with weekly peaks. These peaks correspond broadly with the weekly lectures, indicating that students were using the website to prepare for the lectures. During the mid-semester break there was a noticeable drop-off of page views. The small amount of usage suggests that some students used the website to catch up or to progress with their assignments. In the second half of the semester the graph shows a less distinct pattern, but with a spike leading up to the deadline for Discussion Papers 3 and 4. In the next iteration of the course we will monitor students' use of particular pages and elements of the website.

Figure 2

Google analytics data on use of the new course website



Online teaching competencies

In addition to the skills and experience required to teach a postgraduate course at university level, additional competencies are required for online teaching (Oliver & Herrington, 2001). The range of online teaching roles and associated competencies proposed more than a decade ago by Goodyear, Salmon, Spector, Steeples, and Tickner (2001), still hold true with current e-learning implementations. We offer our reflections based on a selection of these roles that were relevant to this blended course: the roles of process facilitator, content facilitator, technologist, manager and administrator, assessor, and researcher.

Process Facilitator

Goodyear et al. (2001) propose that the process facilitator is concerned with facilitating a range of activities that are supportive of student learning. Initially we gave too little attention to this role in the online domain because it is easier to welcome students, establish ground rules, create community, manage communication, and model social behaviour in face-to-face teaching. However, these components are equally important for successful online learning experiences, but require innovative and pro-active approaches. For example, encouraging initial participation and making contributions; we found that while some students were happy to contribute (e.g., in online case studies, assignment Q&A's) others were not participating. We therefore went to some lengths to encourage all students to make at least one contribution to one online case study discussion forum, specifically, to help students become comfortable in expressing a view online.

Having acknowledged that these process competencies are equally important online as in traditional settings, the specific means of achieving successful outcomes is somewhat different in our view. A specific problem is that in an era of information overload (Edmunds & Morris, 2000), the online setting is a particular challenge because most people do not want to be bombarded with emails and other e-communications. Establishing a learning community online using online dialogue runs the risk of becoming unwanted "noise" and spam. This may mean posting fewer high quality communications rather than sending many messages. Also, the facilitating process is likely, in our view, to require an ongoing mixture of face-to-face and online efforts. For example, demonstrating good etiquette in online discussions is something that can be discussed in class and then simply demonstrated by staff in online discussions.

In our experience, the partnership between lecturer and learning designers allowed for some peer observation of teaching and gathering of informal feedback from students. From these observations particular points on facilitating student learning were noted:

- The majority of students preferred doing the case studies in class, because they preferred discussing the answers in that forum.
- Where case studies had been discussed online, students expressed a desire to have some model answers from the lecturer and a follow-on discussion in class in which the online contributions were further considered (i.e., to receive further feedback). This suggests that the quality of the discussion and tutor feedback received via the online domain was not sufficiently deep.
- Students were more likely to participate online if a task was graded. If not, other priorities prevailed.
- The provision of the online Q&A Forum was viewed by students as very useful. It was noted that having a robust structure to the Q&A Forum was important. Initially, our technology within CourseBuilder didn't allow for provision of comments structured by topic, but this feature has subsequently been incorporated.

While a large number of students did not initially participate in the online forums (case studies and Q&A), the vast majority did read them. This suggests that the online discussions may be useful to more students than the number of participants in the actual forum. Such "active lurking" may be a positive learning experience for students.

On reflection, the process facilitator role is probably the hardest part to integrate into a blended learning environment, but possibly the most critical. In hindsight we didn't give this aspect sufficient attention in our first cycle, and will need to be more pro-active and imaginative in the next iteration. One positive outcome was that the process itself of creating the website and innovating with features such as online case studies, the Q&A Forum, and so forth, contributed to positive engagement with the students. Informal feedback was very positive, with students commenting favourably on the innovations (i.e., there was a positive appreciation that we were making efforts to innovate).

Content Facilitator

In contrast to the process facilitator, the content facilitator is concerned directly with growing the understanding of the course content. During the implementation of the first cycle it became increasingly apparent that use of ICT opens new opportunities to incorporate a wide range of rich content that is already available, for example, by providing links to other materials, incorporating Lynda.com training materials, and embedding relevant videos to illustrate key points.

Moreover (and excitingly in our view), it opens more opportunities to draw on the rich experiences of students. This was something that became increasingly apparent during the implementation of the first development cycle. Towards the end of the semester we encouraged students to use some of the templates provided on the course website, but also to offer their own templates for others to use. In future course iterations we will invite students to draw on their industry knowledge by contributing examples from their own experience in relation to the week's topic. They will be able to post these online and have them peer assessed.

The trial use of the supplementary online training videos in Lynda.com was also popular. Informal feedback from students on access to these additional materials was positive, particularly in relation to the online tutorials on project management software.

Another feature that was positively received by students was that the entire content of the course, including all assignments, was available at an early stage. Although the website was slightly restricted during the first two weeks of the semester (while students were still finalising the course selections and enrolments), thereafter the website was opened for all future weeks' topics. We deliberately took this approach rather than releasing content on a week-by-week basis in order to give maximum flexibility for students. For example, students working part-time could, if they so wished, commence assignments early in order to manage their studies round their employed workload. Although there was very moderate evidence of students progressing in advance of the weekly topics, the advance visibility gave students a sense of a well-structured and organised course. In informal feedback students were positive, saying that the website was useful in the way that it supported the course, and they appreciated the clearly structured website materials.

During the semester some students asked for more examples (such as industry case studies) to be added to the website as additional reading. Although the core text book and other referenced text books provided numerous case studies, it appeared that some students were looking to the website as providing the core content. The flexibility of the CourseBuilder software makes it easy for us to expand the content to incorporate such additional materials. However, it does introduce a dilemma: to what extent do we expand the content on the website as replacing core content that might typically be provided in textbooks? We don't envisage the website as ever being as comprehensive as a good text on the subject matter, but we do see a blurring between website, e-books, and traditional textbooks. One advantage of using the website is that it gives the lecturer a tool to update materials quickly, which provides a more interactive environment. However, this imposes a requirement on the lecturer to manage the content and ensure clarity of structure.

Technologist

According to Goodyear et al. (2001), the technologist role is concerned with making or helping to make technological choices that improve the environment available to learners. This is a specialist role, however, it does not have to be a barrier for the technophobe in using e-learning. Embarking on the first cycle of design and implementation, the course lecturer had no previous experience in developing websites, nor in making lecture recordings. The lecturer can be described as "technology aware", probably of average computer proficiency for an academic, but able to appreciate the implications of using technology in teaching. The learning designer was a specialist in the field, with experience in advising academics on implementation issues, and able to draw on the support of other specialists such as the CourseBuilder developer. Hence, the lecturer was able to draw on the necessary support to help with implementation, which was important for the successful deployment of the new technologies. There were only a small number of technology glitches which were quickly rectified. Students were surprisingly tolerant of such glitches.

Manager / Administrator

The use of e-learning technologies does offer opportunities to enhance the management and administration of the course. Advance effort is required to set up the technology systems to ensure they work effectively, but once established, provides benefits for lecturer and students alike. These benefits include better organisation, fewer errors, improved efficiency and ultimately, better quality of administration. In our case particular examples were:

- The use of an online booking system for office appointments between staff and students. Students were able to self-book appointments.
- The use of the online Q&A Forum. Whilst the online Q&A had benefits in the process role as previously outlined, it also helped significantly in reducing the number of requests from students for an office appointment to answer simple, repeated questions. It reduced too, the number of emails received (compared to previous years in running the course).
- Online booking for access to additional materials (Lynda.com).
- Use of an online system for nominating teams for one of the assignments.

Monitoring the course website required additional administration which was primarily related to ensuring questions posted by students were answered in a timely manner. We set a target of answering queries within 24 hours during the week, or first thing Monday morning for queries raised over a weekend. The majority of queries were posted at night and could be answered the following morning. Overall, the reduction in administrative input, in turn, gave the lecturer more time to devote to other value-adding work such as research, and improving teaching content. Also, the website is now available for future years, making it easier to prepare the course each year.

Assessor

This course was mainly assessed using assignments, and this remained unchanged from previous years. One new feature was the use of multiple-choice, self-test questions and answers on each week's topic which were designed to offer students an option to test their knowledge. These tests were not included in the formal assessment in the first year, partially due to the trial nature of the course website development (i.e., risk mitigation) and also, because we were not convinced that multiple-choice questions were suitable for assessing an advanced topic. Not many students used the multiple-choice tests, and some students asked for more feedback to supplement the automated answers which we will provide in future. Also, we will consider using peer assessment in future years for students' contributions, as well as to assess one of the major team-based assignments.

Researcher

Developing and implementing this blended course provided numerous opportunities for research; on our own teaching practice as well as on how these technologies supported students' learning experiences. As mentioned earlier, the purpose of this pilot project was to trial new e-learning approaches before adopting them more widely in the MEngSt programme. The design research approach gave us a research framework that these and future findings contribute to. We have developed a research strategy for the second cycle of development and implementation, to explore in more detail how students source their information, and to collect more detailed quantitative qualitative data sets. We outline the research design for the next phase later in this paper.

Putting the roles together: Requirement for leadership

Each of these six roles proposed by Goodyear et al. (2001), namely, the process facilitator, content facilitator, technologist, manager and administrator, assessor, and researcher are facets of the course coordinator's role in a study programme such as the MEngSt. These roles can be undertaken by an individual (i.e., single lecturer) or by a small team (in our case two individuals with specialist support from other colleagues). In addition, we propose that there is one role missing from the Goodyear et al. model, namely, a leadership role.

This is not the place to review leadership theories or models here. Suffice to say there is a considerable body of knowledge and literature on leadership (e.g., Bennis & Nanus, 2007). The leadership role is critically important in developing and delivering a successful e-learning course (Marshall, 2011). The leader is primarily concerned with setting the objectives, sharing the vision, and influencing others to achieve these objectives. Without exercising some leadership for a high-level long-term goal, e-learning initiatives are unlikely to deliver excellence.

Whilst we are not so bold as to claim that we have delivered excellence yet, we started with an overall objective, and have embarked on a continuous improvement cycle seeking to achieve excellence. In this sense we borrowed from some of the organisational excellence models such as Lean Thinking (Womack & Jones, 1996). This provided the initial impetus for embarking on the project, and provided us with ongoing sustenance when effort was required.

We also believe that a move from traditional delivery to a successful blended approach with e-learning is something that is better undertaken on an incremental basis, rather than a single "big bang" technology change (Quinsee & Sumner, 2005). This has the advantage of making incremental changes based on feedback from students and other stakeholders. As such, a sustained vision is needed, which is unlikely to be provided by the eight roles of online teaching proposed by Goodyear et al. (2001). Just as these authors identify competencies associated with the roles for online teaching, so we propose competencies for the role of leadership in e-learning integration as:

- Set an overall objective for e-learning implementation in a course
- Share the objective with others, and communicate and influence others to help achieve the objectives in an ongoing sustained manner
- Understand the possible advantages and associated risks in using e-learning technologies, and establish suitable approaches for managing threats
- Show enthusiasm and demonstrate commitment through personal actions
- Strive for excellence.

Summary: Roles for online teaching and possible future improvements

We have provided a qualitative description of our reflections on six (of the eight) roles for online teachers proposed by Goodyear et al. (2001). These are summarised in Table 6 with improvements we have formulated based on the first implementation of the blended course.

Table 6

Summary: Online teaching roles and suggestions for future improvements

Role	Summary of key findings	Suggested improvements for our pilot
Process facilitator	Requires pro-active effort to make online delivery successful Multiple communication channels need to be coordinated with a central authoritative hub (i.e., all communications duplicated on the website) Students are more likely to engage in online learning activities if they are assessed Some students are likely to engage in "active lurking" which is not necessarily a negative thing	Increased effort on process elements Post all information on the website and make announcements in form of summary with link to the website as a hub Incorporate aspects of assessment of different e-learning approaches used during course delivery Design hooks to engage active lurkers and encourage them to participate more openly
Content facilitator	The use of ICT expands the horizons of course content e-Learning approaches open options to draw on the rich experiences of students to contribute to course content Making course content transparent via a website helps students understand overall course structure Making content available via a website allows for asynchronous learning options The flexibility offered by some ICT applications allows for rapid updating of course content, taking advantage of learning opportunities, and responding to student needs	Expand options for contributions from students, e.g., case studies, presentations, discussion papers Students could contribute content such as templates on the course website using student pages or a wiki
Techno-logist	A willingness to experiment is required The course lecturer does not have to be a technology expert, provided support from other experts is available when needed Some technology glitches are to be expected but student tolerance is good provided problems are addressed quickly	Options to use other technologies to support learning objectives, such as project management simulations and social annotation tools
Designer	There should be clear linkage between course objectives, learning outcomes, and e-learning design Design can be incremental; some ICTs need to be designed prior to commencement of the course, others must be moderated throughout the teaching semester Ongoing online updates help ensure the course is dynamic	Use findings from the pilot to inform course design for future
Manager / Administrator	Use of ICT requires up-front administrative effort, but early planning helps with management of the course, which ultimately helps improve efficiency and effectiveness Use of an online Q&A forum necessitates a commitment to respond in a timely manner (24 hours in our case)	Continue to upgrade the course website supplemented by other ICT applications to assist with administration
Assessor	Self-test multiple-choice tests were only moderately successful and require more feedback	Include aspects of peer assessment
Researcher	Embarking on a design research approach when introducing e-learning options in a course opens options over a number of cycles to undertake meaningful research	Undertake a research project for the second cycle of development
Leader	Sustained leadership is necessary	Share the vision with students and other stakeholders

Research Design for Second Iteration

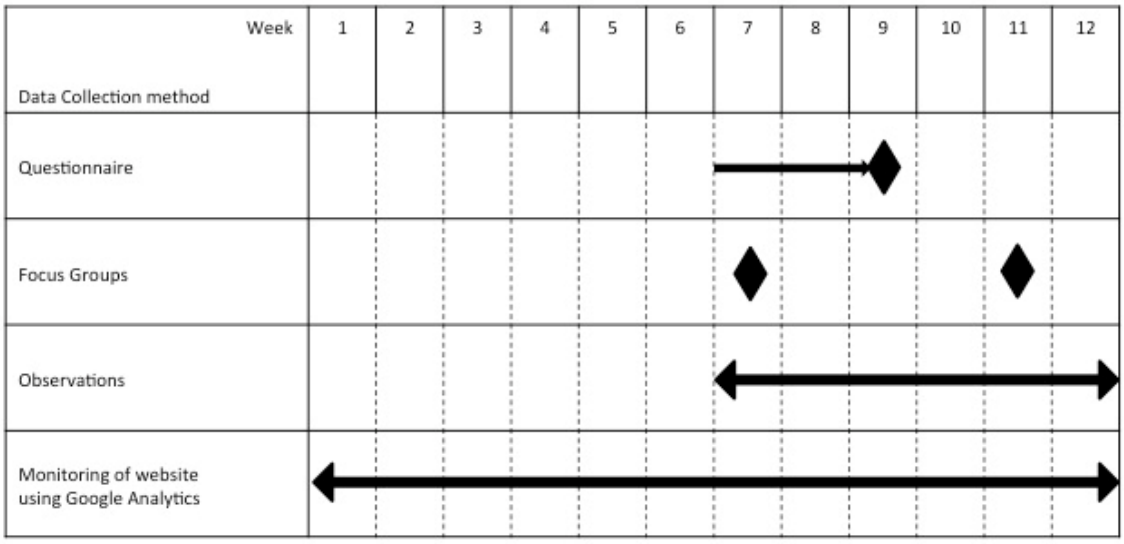
During the second iteration of the blended course our research focus will shift to address a particular research problem that we identified in the modern tertiary education environment, where students have access to a vast array of knowledge resources which are accessible via numerous communications channels. Many of these channels are partially or completely accessed via modern ICT systems. For example, traditional face-to-face lectures are now supplemented with lecture recordings. We have received

ethics approval to investigate information flow patterns and issues in the postgraduate project management course in order to identify possible means of improving teaching methods and e-learning technologies that support student learning.

Two new innovations will be introduced into the course: project simulation software, and an online social annotation tool for collaborative student note-taking during lectures. In order to gain a better understanding of the effectiveness of these two innovations, research is planned that will enable the researchers to gain more in-depth data on how students access information for decision making when undertaking assignments in the course. The planned research methods are shown in Figure 3.

Figure 3

Research methods for the second design and implementation of the blended course



We will collect data on how students source information. We will use a matrix that seeks to link human and documentary sources of information with forms of communication and means of access. In this way we seek to gain insight into student preferences for information sourcing, which will inform our design for future interactions.

Conclusions

This innovative approach to designing and implementing a blended course has resulted in a number of benefits, including:

- Increased student satisfaction: the departmental surveys of student satisfaction showed an increase in student satisfaction for this course.
- Improved productivity during the delivery of the course. This repaid the initial investment in time by the lecturer in developing the course website and adopting new technologies. In particular, the lecture recordings and online Question and Answer Forum streamlined queries relating to assignments, and ensured that all students received the same information. This was a popular feature of the online course components.

- Increased flexibility for student learning. Whilst traditional teaching via face-to-face lectures, tutorials, and meetings was not replaced with online learning, interaction via the course website, lecture recordings, online case studies and so on, offered students multiple learning strategies. Flexibility, not only of pace, time and place of study, but also of learning style and learning opportunities, was made possible by these innovative online technologies (Collis & Moonen, 2002).

Considering the benefits of the e-learning innovations used in this trial, we conclude that the benefits are real and significant, and therefore we will apply lessons learned from the pilot study to other courses in the MEngSt programme. However, we also feel that it would be a mistake to move to a distance learning model at this stage; rather that the e-learning approaches supplement (not replace) the more traditional teaching approaches by further developing a blended course. This is a pragmatic decision given that all other Masters courses in the Masters programme are currently delivered face-to-face, and that this pilot project is a first attempt at using a blended approach within this programme. Adopting a blended approach covers the various needs of our current students, and makes an incremental change rather than a radical departure from the norm.

The continuous teaching presence of the lecturer, from design through to implementation of the course, was monitored during the pilot and analysed with reference to Garrison, Anderson, and Archer's (1999) Community of Inquiry framework. This approach meant that we were able to engage with students and colleagues in a) checking assumptions upon which the course was designed, and b) seeking continuous improvement in the delivery of the course, which was well received. The particular innovations used thus far, are in our view, less important than adopting an innovative, scholarly approach to teaching. Using such collaborative and participatory methods to trial flexible e-learning options for substantial change to teaching postgraduate engineering courses extends the potential for student access beyond this institution both nationally and internationally. This has significant implications for up-skilling professionals in a wide range of engineering and business industries.

References

Anderson, T., Rourke, L., Garrison, D., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks*, *5*(2), 1–17.

Bates, A. (2005). Charting the evolution of lifelong learning and distance higher education: The role

of research. In C. McIntosh (Ed.), *Perspectives on Distance Education: Lifelong Learning and Distance Higher Education* (pp. 133-150). Paris, France: UNESCO/Commonwealth of Learning.

Bennis, W.G., & Nanus, B. (2007). *Leaders: The strategies for taking charge*. (2nd ed.). New York: HarperCollins.

Collis, B., & Moonen, J. (2002). Flexible learning in a digital world. *Open Learning: The Journal of Open, Distance and e-Learning, 17*(3), 217–230. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/0268051022000048228

Conole, G., Dyke, M., Oliver, M., & Seale, J. (2004). Mapping pedagogy and tools for effective learning design. *Computers & Education, 43*(1–2), 17–33. Retrieved from http://www.sciencedirect.com/science/article/pii/S0360131503001404

Conole, G. (2012). *Designing for learning in an open world.* New York: Springer.

Daniel, J. (2012). Making sense of MOOCs: Musings in a maze of myth, paradox and possibility. *Journal of Interactive Media in Education, 18*. Retrieved from http://www-jime.open.ac.uk/jime/article/viewArticle/2012–18/html

De Cicco, E., & Kennedy, S. (2012). *Learning in a digital age: Extending higher education opportunities for lifelong learning*. Retrieved from http://www.jisc.ac.uk/publications/programmerelated/2012/learning-in-a-digital-age.aspx

Edmunds, A., & Morris, A. (2000). Problem of information overload in business organizations: A review of the literature. *International Journal of Information Management, 20***,** 17–28.

Garrison, D., Anderson, T., & Archer, W. (1999). Critical thinking in text-based environments: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2), 87–105. Retrieved from http://www.sciencedirect.com/science/article/pii/S1096751600000166

Garrison, D., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The Internet and Higher Education, 13*, 5–9.

Gosper, M., Green, D., McNeill, M., Phillips, R., Preston, G., & Woo, K. (2008). *The impact of web-based lecture technologies on current and future practices in learning and teaching*. Strawberry Hills, Australia: Australian Learning and Teaching Council.

Goodyear, P., Salmon, G., Spector, J., Steeples, C., & Tickner, S. (2001). Competencies for online teaching: A special report. *Education Technology Research and Development, 49*(1), 65–72.

Hamer, J., Cutts, Q., Jackova, J., Luxton-Reilly, A., McCartney, R., Purchase, H., . . . Sheard, J. (2008). Contributing student pedagogy. *ACM SIGCSE Bulletin, 40*(4), 194–212.

Kozma, R. (2005). National policies that connect ICT-based education reform to economic and social development. *Human Technology: An Interdisciplinary Journal on Humans in ICT Environments, 1*(2), 117–156. Retrieved from http:www.humantechnology.jyu.fi

Marshall, S. (2011). Change, technology and higher education: Are universities capable of organizational change? *Journal of Asynchronous Learning Networks*, *15*(4), 22–34.

Mohd, S., & Aziah, I. (2012). Learning styles and perception of Engineering students towards online learning. *Procedia - Social and Behavioral Sciences*, *69*, 669–674. Retrieved from http://www.sciencedirect.com/science/journal/18770428/69

Oliver, R., & Herrington, J. (2001). *Teaching and learning online: A beginner's guide to e-learning and e-teaching in higher education*. Mt Lawley, Australia: Edith Cowan University. Centre for Research in Information Technology and Communications.

Philip, R., & Nicholls, J. (2007). Theatre online: The design and drama of e-learning. *Distance Education, 28*(3), 261–279. doi: 10.1080/01587910701611310

Picciano, A. (2011). Introduction to the special issue on transitioning to blended learning. *Journal of Asynchronous Learning Networks, 15*(1), 1–5. Retrieved from http://jaln.sloanconsortium.org/index.php/jaln/issue/view/23/showToc

Quinsee, S., & Sumner, S. (2005). How to manage the big bang: Evolution or revolution in the introduction of an MLE? *Aslib Proceedings: New Information Perspectives, 57*(2), 146–156.

Patterson, D. (2011). Impact of a multimedia laboratory manual: Investigating the influence of student learning styles on laboratory preparation and performance over one semester. *Education for Chemical Engineers, 6*(1), 10–30.

Reeves, T., Herrington, J., & Oliver, R. (2005). Design research: A socially responsible approach to instructional technology research in higher education. *Journal of Computing in Higher Education, 16*(2), 96–115. Retrieved from http://link.springer.com/article/10.1007%2FBF02961476?LI=true

University of Auckland. (2012). *The University of Auckland Strategic Plan 2013–2020. Auckland*. Retrieved from http://www.auckland.ac.nz/uoa/home/about/the-university/official-publications/draft-strategic-plan-2013-2020

Womack, J. P., & Jones, D. T. (1996). *Lean thinking: Banish waste and create wealth in your corporation*. New York: Simon & Schuster.