Blended Course Design for Cooperative Delivery – A Case Study

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***Abstract**: A blend of online and face-to-face learning offers many benefits to students, staff and institutions, including improved learning opportunities, flexibility in time and place of study. We describe the particular blend that has been employed in restructuring a Solar Energy Technology course at a major Australian university. The most striking feature of the redesign is that face-to-face lectures have been replaced with online, interactive but asynchronous lecture-like presentations. The course has been delivered once in the new format, in 2010. The new course structure is an essential factor in a project to share courses between institutions, with students participating online as a single cohort, but face-to-face activities replicated at the two institutions.*

Introduction

University courses are increasingly taught using some combination of traditional face-to-face activities and online learning activities. However the nature of the blend varies considerably, in purpose, timing and ratio of the two styles, and the nature of each component. Online aspects may augment a more traditional course structure or may completely replace some parts (Ragan, 2007). Online aspects may focus on content delivery, administration, assessment, facilitating reflection, facilitating interaction, or a myriad of other components.

This paper describes a pilot project in blended delivery for engineering at a research-intensive Australian university. An existing face-to-face course has been completely redesigned following blended course principles, where the key idea is that all content is delivered asynchronously and online, allowing self-paced interaction with the material, and face-to-face time is reserved for interactive learning events. The design is "student-centred, knowledge-centred, assessment-centred and community-centred" (Bransford et al., 2000).

The course redesign to blended delivery facilitates a course sharing project between two Australian universities (Blackmore, K. et al., 2010). Joint development and delivery of courses will contribute to new majors and programs at each of the institutions, and reduce redundancy in course offerings across the two institutions. Course sharing allows universities to draw on each other's respective strengths to provide students with a wider choice of subjects while remaining enrolled at their home university.

Context

Most engineering courses follow a typical a pattern of lectures, tutorial, and laboratory sessions. Assessment tends to focus on a written examination. This model of course design is well understood, is believed to be efficient for dealing with large numbers of students, and is familiar and comfortable for most academics delivering courses. However, as Phillips (2005) points out, it is not well aligned with current knowledge about how students learn.

The traditional course structure described above puts an emphasis on transmission of content in lectures, in which students are passive recipients. However research indicates that much more active

engagement by students is necessary for effective learning. Moreover, active learning approaches are more likely to foster skills that are well aligned with engineering industry requirements of graduates (Goel and Sharda, 2004).

A blend of online and face-to-face learning activities can facilitate a move from passive to active student engagement in learning, by allowing students increased control over how, when, and where they learn. Educational online activities can enhance learning as they trigger learner activity, reflection, and self monitoring of understanding. Twigg (2003) observed that online learning was better at keeping learners engaged in the learning process for a longer duration than face-to-face learning. Twigg also demonstrated that the inclusion of media, videos, and flashier templates does not necessarily enhance learning, but the degree to which the learner is given control over these media elements does.

In line with the rise of social media, the emphasis in online learning is moving from content delivery towards facilitating a community of practice. Garrison and Kanuka (2004) argue that technology can "facilitate a simultaneous independent and collaborative learning experience", as learners can be independent of space and time yet still be together and engaging with content. The asynchronous nature of internet discussion is a positive factor in encouraging reflective learning practices and careful engagement with complex issues.

While well designed completely online courses have been shown to be educationally effective (Means et al, 2009), many students and staff choose campus-based education over online distance education because they find the face-to-face interaction of on-campus learning activities to both enjoyable and helpful. Blended courses can offer a balance between the interpersonal contact of face-to-face education and the flexibility and active learning opportunities afforded by online education.

Method

We have piloted a particular blended course model for the course Solar Energy Technologies. This course has been offered for many years, but was extensively redeveloped in 2010 for the purposes of the current project. Previously, the course was offered in a traditional manner with lectures, tutorials and laboratories spanning over a 13 week period. Assessment was primarily summative, that is assessment 'of' learning. The new, blended course structure supports formative assessment 'for' learning.

Hours	1	2	3	4	5	6	7	8	9	10	11	Total
Wk 1	Intro	Intro	L1.1	L1.2		Quiz 1	Forum					6
Wk 2	Tute 1	Ex 1	Ex1	L2.1.1	L2.1.2		Ex 1	Ex 1	Ex 1	Forum		10
Wk 3	Tute 2	Ex 2	Ex 2	L2.1.3	Quiz 2	L2.2.1		Ex 2	Ex 2	Ex 2	Forum	11
Wk 4	Tute 3	Ex 3	Ex 3	L2.2.2	L2.2.3		Quiz 3	Ex 3	Ex 3	Ex 3	Forum	11
Wk 5	Tute 4	Ex 4	Ex 4	L2.3.1	L3.2.2a		Quiz 4	Ex 4	Ex 4	Ex 4	Forum	11
Break	L3.2.2b	L3.2.2c	L3.1	L3.2.	L3.3							7
Wk 6	Tute 5	Project	Project	L4.1	L4.2		Project	Project	Project	Project		10
Wk 7	Tute 6		Quiz 5	Project	Project	Project	Project	Project	Project	Project		10
101	Tute 7		Quiz 6	Project	Project	Project	Project	Project	Project	Project		10
Wk 9	Tute 8	Project	Project	Project	Project	Project	Project	Project	Project	Project		10
Wk 10	Tute 9	Ex 5	Ex 5	Ex 5	Ex 5	Ex 5	Project	Project	Project	Project		10
Wk 11	Tute10	Project	Project	Project	Project	Project	Project	Project				8
S1												10
S2												10
Exam												10

Table 1: Time budget for Solar Energy Technologies course. This indicates the number of hours students are expected to devote to each activity each week. Grey boxes indicate face-to-face activities, and black boxes indicate self study. The break is three weeks long.

The course is structured around four types of learning activities: online lectures; online quizzes; tutorials and exercises; and a group project. The tutorials and exercise are face-to-face activities, replicated at each of the two participating universities. All of the other activities are online. Courses run over the standard 13 week semester at each institution and students are supported using the "dialogue tool" in the learning management system. This email-like tool keeps a record of discussions between students and staff within the context of the course. In addition, forums facilitate discussion among the whole class. The students' engagement with the course throughout the semester is guided by a "time budget", illustrated in Table 1. The table reveals that there is greater emphasis on new content at the beginning of the semester and application towards the end of the semester.

A core idea of the course design is that content will be delivered online and asynchronously, so that students are able to engage with the material at their own pace, in their chosen location, and at a time convenient to them. Course material is offered in 20 minute long lecture-like online presentations (labelled L1.1 etc. in Table 1), created using Adobe Presenter or Articulate Presenter. These presentations can be accessed in a number of modes appropriate to a variety of learning styles: powerpoint with synchronised audio; powerpoint with transcribed notes; or audio only. Interactive applets that illustrate the concepts are embedded in presentations, as well as links to various other websites which students are expected to follow and study. While the presentation is 20 minutes long students are expected to devote an hour to the presentations, as they follow the recommended hyperlinks, complete the recommended activities, stop to contemplate points raised, and repeat sections as needed. This encourages the student to adopt a cyclic 'passive to active' mode to assist retention of knowledge.

Online quizzes (labelled Q1-5 in Table 1) are formative assessment items used throughout the semester to test students' understanding of the material presented in the lectures. They consist of 5 questions (multiple choice or short answer). Students have two attempts at each quiz, but do not necessarily get the same questions, or in the same order, on their second attempt. Quizzes are available progressively for 1½ weeks each during the semester, so that students have a choice of when to study, but are encouraged to move through the material in a timely manner.

Tutorials (labelled Tute 1-10 in Table 1) give students the opportunity to further apply their understanding of the course material, and to discuss concepts face to face with other students and a tutor. Tutorials are conducted for groups of 20-30 students, and the questions students attempt in the tutes are mostly similar to the types of questions in the final exam. Students are expected to attempt the tute questions before the tute, and to actively participate during the tutorial.

Exercises (labelled Ex 1-5 in Table 1) are designed to give students the opportunity to develop a deeper understanding of the lecture material, extend their analytical skills, and gain hands on experience with equipment. Some of the exercises involve computer modelling, and others involve accessing relevant data from suitable websites. Some are individual, while others are group based practical activities. Exercises take 2 hours face-to-face, plus about 3 hours to write a report, which is submitted for grading.

The group project (labelled Project in Table 1) gives students the opportunity to integrate many of the aspects of photovoltaic systems covered in the course utilizing a systems approach. Students develop their ability to work in a team, to use online tools for record keeping and project management, and to find and critically assess required information. Private discussion forums, wiki workspaces and collaborative reference databases are provided for each project group.

Students from the two universities involved in this blended course pilot project participated equally in this course. Online they were treated as a single cohort, but face-to-face activities were replicated at each institution. In order to ensure equivalent face-to-face experiences for students at each institution, detailed lesson plans for each tutorial and exercise were created, and the teaching team met each week using teleconferencing and virtual classrooms to discuss plan for the face-to-face sessions as well as any issues arising.

Project groups spanned the two institutions. In the project, students worked in teams to carry out a design exercise or feasibility study revolving around photovoltaic technology. Early in the semester, stimulus questions were used to scaffold discussion about project topics in online discussion forums.

Project groups were then assigned according to interest in the topics that emerged, and the work was initiated by face-to-face discussion sessions with tutors at their home institutions. The rich variety of asynchronous online communication options facilitated collaborative project completion by groups formed across the two institutions.

Students were not familiar with the blended course structure. To assist students to become orientated to expectations and conventions of the new course design, a detailed online Guided Tour presentation was created, and a face-to-face introductory session was held at each institution.

Reflections

In all, 127 students completed Solar Energy technologies from two institutions. A comprehensive evaluation of the course is underway, including both qualitative and quantitative evaluation process. Aspects of the evaluation include student satisfaction, teacher satisfaction, student learning, teacher learning, and institutional support for and effects of the changes. Evaluation techniques include student surveys, focus groups with student and interviews with teaching and administrative staff. It is anticipated that a full account of the results of the evaluation will be published in 2011.

Initial feedback indicates students and staff appreciate the quality and accessibility of the online presentations, but some have reservations about the reduction in face-to-face interaction. One student comments that: "The on-line nature tends to fit my part time studies arrangement well (I work full time and study part time). Because this is online, the tutorials are an extremely important component of the course, since this is where we really get to ask questions". It is clear that careful consideration of the balance between online materials, independent study and face-to-face interactions is necessary, and there is room for further development of the face-to-face component in particular. Students have been particularly appreciative of the convenience of viewing lectures online, flexibility to choose when to study, and being able to pause and replay lecture material.

Our experience to date has shown that redeveloping a course into blended mode does not save time or effort, in fact more work has gone into the design and delivery of this course compared to a traditionally structured course. In addition, staff can be hesitant because they feel exposed by the permanent and visible nature of their content delivery and interactions with students. It is hoped that only minor redevelopment will be necessary next year, so that the delivery effort will be equivalent to or less than a traditional course.

One of the reasons for the extra work is that the change of practice means that an expanded set of skills are necessary (Aycock, 2002). A functional and broad teaching team is necessary in order to provide expertise in building an effective online learning community among the students, creating online materials and structuring the course within the learning management system. The reduction in face-to-face contact time increases the focus on the quality and consistency of the tutorials and exercises, so the teaching team need to jointly plan these activities to be highly interactive and engaging. Consistency and scaffolding of marking must be arranged. Since many people are involved in the delivery, material should be developed and uploaded prior to the beginning of the course to ensure smooth running during semester.

Developing and delivering this course has involved an effective mutual exchange of educational expertise between two institutions. Benefits and issues arising from the shared nature of this course are discussed in (Ascilite submission, 2010).

Future Opportunities in Blended Courses

One other undergraduate course has been shared as part of this project in Semester 1, 2010 (Intelligent Manufacturing Systems). This course incorporated online study groups working together on typical tutorial questions, instead of face-to-face tutorials. The teaching team were closely involved in facilitating establishment of the online study groups, and virtual classroom technologies were used to augment discussion forum interactions for each study group. In future courses we would like to use this online tutorial idea again, with a view to freeing up time for face-to-face “seminars” which facilitate deeper discussion of concepts subsequent to completion of tutorial type questions. These can then be followed up online with reflections and asynchronous chat.

A third course is being shared in Semester 2 of 2010 (Supply Chain Management). In this course, Grid Access videoconference facilities have been used to allow joint seminars across the two institutions, with staff and students in each room communicating together. We have also included industrial case study material as interactive, multimedia online lesson that students can step through as part of their self-paced learning.

From 2011 the two institutions will offer a new, jointly delivered, Master of Engineering Practice that relies on blended courses. It is anticipated that the students for this program will be full time workers, possibly not close to either institution, so in this case the face-to-face component of the blend will take the form of a full day or two at the beginning of the delivery period, backed up by synchronous online tutorials throughout the semester.

The two institutions have agreed to share a dozen or so senior undergraduate and postgraduate courses, across a broad range of engineering disciplines, over the next few years. There is enormous variety in the online and face-to-face components that can make up a blended course, and we anticipate that different variations in the blend will be appropriate to each of the courses to be shared. Deciding what is right for each course will require considering the course learning objectives, the nature of the course content, and the benefits of each of the instructional methods for reaching those objectives.

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