Changing spaces: using technologies to enhance student and teacher engagement through effective pre-lecture engagement (EPLE)

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Many leading innovators in higher education are seeking to change the nature and purpose of face-to-face (f2f) sessions, aiming to morph the traditional university lecture into something that is more interactive and student driven. Underpinning this changing lecture dynamic is a focus on the learning that students are required to achieve in order to be best prepared for, and thus gain maximum benefit from, the f2f session. This project team has been successfully carrying out a range of effective pre-lecture engagement activities (EPLE) through the use of learning technologies, with attested improvement in student outcomes and progression rates, across two different disciplines. Both student and teacher engagement has been enhanced through the development of 'interactive online learning modules' (IOLMs) in Oral Health that are completed prior to the scheduled f2f session, and 'crash courses' (CCs) in Civil Engineering that are conducted in class within the first 10 minutes of the f2f.

Keywords: engagement, pre-lecture preparation, interactive lectures, learning technologies

Introduction

Underpinning many recent moves away from the standard lecture towards more interactive f2f sessions is a focus on what students need to do and to learn in advance of that session, so that they are appropriately prepared. Team-Based Learning (McCormack, 2011), for example, does this in a quasi-traditional manner, relying on pre-lecture readings, combined with reading guides and preparatory questions. On the other hand, the Integrated Online Learning Modules (IOLMs) approach (Karanicolas and Snelling, 2010) achieves this in a much more

contemporary fashion, providing students with multi-media learning modules and online quizzes up to a week before the scheduled f2f. Despite this difference, both of these approaches place emphasis on moving a significant proportion of the 'broadcast' material, i.e. the one-way monologues that characterised the traditional university lecture, out of the f2f session and into a format that students access independently and work through at their own pace.

We are interested in what sorts of activities constitute *effective* pre-lecture engagement (EPLE) and in this context we have been exploring two different approaches across two disciplines, Oral Health & Civil Engineering at the University of Adelaide. EPLE activities have been developed using a variety of technologies, from the web-based IOLM approach in the Oral Health course, to the relatively straightforward use of a document camera in the Civil Engineering CCs (Willis, 2009). The IOLMs are available for student completion prior to the f2f, in contrast to the CCs that are delivered in the first 10 minutes of class time. Central to both these EPLE approaches is a feedback loop, enabling students to assess their growing mastery of the key concepts, and enabling the lecturer to adjust the f2f session accordingly, and in a 'just-in-time teaching' fashion (Carrington and Green, 2007; Novak, 2006). The aim of both these EPLE activities is to package key concepts and terminology in short episodes, allowing the student to develop a sense of familiarity with the fundamentals before embarking on a deeper understanding and exploration of the content.

For both disciplines the introduction of EPLE activities has transformed the traditional teacher-driven lecture into a more interactive and student-driven learning format, associated with much improved rates of student progress and engagement. Attending classes and participating in active learning experiences through social engagement helps to foster a sense of belonging and consequently impacts positively on student learning (Matthews, 1993). EPLE builds on the students' level of confidence that enables them to engage in active and positive learning experiences. Kolari and Savander-Ranne (2007) acknowledge that the designing of appropriate pre-lecture assignments is most demanding and requires a great deal of self-reflection and interaction with students on the teacher's behalf. However, the use of learning technologies in both the Oral Health and Civil Engineering programs, have assisted us in developing EPLE activities that manage to sustain our students' interest through an increased level of interactivity, flexibility and teacher presence that the more traditional modes of pre-lecture preparation did not seem to offer.

Background of Disciplines

The two courses investigated in this study are within the Bachelor of Oral Health (BOH) and the Bachelor of Civil Engineering (BCE) at the University of Adelaide. While both the courses are at first year undergraduate level, there are several significant differences in respect of course content and student cohorts. In particular, for discipline specific course content the BOH has predominantly text-based and descriptive answers, while the BCE has purely numerical answers. In addition, the number of students is of the order of 40 and 600 for BOH and BCE respectively. There are also differences in terms of the *way* in which the EPLE activities and technologies are used within each discipline. For BOH, the IOLMs are presented prior to the lecture in the form of twenty-minute video podcasts. In contrast to this, for BCE, the crash courses are presented as a warm up to the lecture using a document camera for approximately ten minutes during the allocated f2f time.

Interactive Online Learning Modules

As there are no prerequisite entry requirements for the Oral Health program, students entering the first year human biology course come with a diverse range of experiences and levels of understanding. To overcome the learning challenges that this diversity creates, specific lectures introducing key concepts are selected as the priority areas for developing the IOLMs. Using the *Articulate* software package (Articulate Global Inc., 2011) the lectures are adapted from the existing PowerPoint lecture slides into an online module. A narrative dialogue is recorded for each slide by the two-person teaching team. One lecturer acts as the 'expert' and the other assumes the role of the learner. Approximately 50% of the material usually presented to students in a f2f lecture, is incorporated into the IOLM, allowing new terminology and key concepts to be previewed by the class up to one

week before the lecture and as often as they require to gain a foundational understanding. At strategic points (usually every 4-6 slides), interactive checkpoint multiple-choice questions (MCQs) are inserted and linked to the assessment and grading facility in the university's learning management system (an implementation of Blackboard). Students undertake these checkpoints as a way of revising information covered in the previous slides and to provide them with formative feedback on their level of understanding. Furthermore, analysis of these checkpoint assessments is readily downloaded from the learning management system, enabling lecturers to identify areas covered by the IOLM that need more emphasis or explanation in the f2f session. A sample IOLM can be accessed at: http://ajax.acue.adelaide.edu.au/~allan/embrology/player.html. Note that students are allowed some class time to work through the IOLMs; providing a timetabled session underlines the important role that the IOLMs play in the learning process, rather than being just being considered as optional extras.

In addition, 3-4 minute video recordings, referred to as "QuickBytes", presenting key concepts are uploaded to YouTube and subsequently embedded in these modules. This provides students with further access to, and engagement with their teachers, reinforcing a strong teacher presence. A sample QuickByte video can be viewed at http://www.youtube.com/watch?v=G2TvfgiNHCs. These video recordings are made using a whiteboard and a simple digital point-and-shoot camera. There is very little editing required when transforming these videos into a format that can be uploaded into YouTube. From the teacher's perspective, the additional time invested into the development of these IOLMs is offset by the fact that these modules change the nature of the f2f into a more student driven interactive and engaging learning space. Once developed, these modules need very little input from the teachers to use in subsequent years.

Crash Courses

As the name suggests, 'crash courses' (CCs) are concise ten minute summaries of the ideas students are to meet in the ensuing lecture, and include overviews of the relationship to the sets of ideas articulated in previous lectures, and in the course generally. Initial results seem to indicate that this initiative has eased the sense of dislocation students experience when introduced to unfamiliar concepts. This strategy became the first step in a transformation of the traditional didactic lecture into an interactive workshop using simple technologies, such as a document camera. These CCs are recorded live and are available to students via the learning management system after the lectures to use as a general learning resource.

As the CCs provide students with the capacity to understand and become familiar with the key concepts and new terminology of the ensuing lecture, the learning space changes into a more workshop style format, increasing interactivity and providing more feedback to both students and teacher. MCQs are embedded strategically into the PowerPoint slides of the f2f and students attempt to answer these as they appear on screen. Once students have formulated their responses they are asked to explain their rationale to the student(s) next to them. Compared to previous cohorts who did not engage in this peer instruction (Mazur, 1997), the answers among the students more commonly converge on the correct one as indicated by the show of hands. This process gives meaningful and timely formative feedback to students on their performance and, equally importantly, gives the lecturer feedback as student understanding can be surveyed, and lecture content immediately adjusted to remedy any shortcomings. This interactive workshop style of teaching and learning might normally be reserved for tutorial sizes of 30 students rather than a lecture theatre full of hundreds of first years. However, the introduction of key concepts via CCs at the start of each lecture primes the class to actively participate in the learning experience. The lecturer acts as a facilitator of the students' learning by progressively giving hints and highlighting the potential pitfalls for each MCQ as they discuss their workings with neighbouring students. That they acquire and demonstrate their knowledge and skill before leaving the lecture theatre is imperative for an engineering curriculum, which must build knowledge, competence and confidence in interconnected, scaffolded and sometimes, small steps. The availability of the CCs post session enables students to revise and review the key concepts as often as required.

Interactive Learning Modules

Since the IOLMs were implemented in 2008, there has been an average of 95% completion rate of each class of 36 students. Table 1 outlines the qualitative data that has been collected on the students' views between 2008-10 via formal student feedback surveys and focus groups, as well as unsolicited emails.

Table 1: Qualitative results for IOLMs from a sample of student feedback systems.

Formal student feedback surveys	• *I felt I had access to the tutors in my own home* • *I was able to pause the IOLM to reflect on fantastic analogies I will never forget* • *IOLMs are a convenient and valuable learning resource….they help me to understand the topic better before the lecture* • *Having visual and auditory resources helps reinforce the message more effectively*
Unsolicited student emails	• *Just wanted to say I really enjoyed the IOLM! I think it's a great way to learn things!* • *I have just finished the online learning module for connective tissue - it was great!* • *Have to say, loving this interactive online learning. If I don't understand something, I can pause, read up on it and follow the rest easier :)*
An analysis of results from student focus groups conducted from 2008 – 2010.	• *A more efficient learning environment - students felt that they learnt better than traditional approaches* • *Improved students' engagement to the point where they were discussing content outside of class* • *The dialogue of two lecturers was lively and entertaining, underpinned by their ability to provide effective explanatory images and metaphors.* • *Opportunity to access the IOLMs 'on-demand' and at a time that suited their schedules on or off campus* • *Asynchronous availability of their facilitators, through online collaborative dialogue embedded in IOLMs* • *Opportunity for students to attend the f2f session with the same level of understanding, arming them with the confidence and underpinning knowledge needed to engage in the application and integration of their conceptual understanding in the classroom environment* • *Identification and reinforcement of key concepts in both the online and f2f experience* • *Ability to contextualise and make sense of their learning through both independent reflection and collaborative peer group learning.*

In a quantitative sense, there has been a noted improvement in assessment outcomes for the Human Biology program. Using comparative assessment metrics, the class average for the final exam has increased slightly from 67% in 2007, pre IOLMs, to an average of 72% from 2008-2010 post IOLMs. However, the most significant impact has been witnessed in the student progression rates. The failure rate pre IOLMs for the semester 2 exam was 15% in 2007, decreasing to an average of 6% between the years of 2008-2010 and possibly signifying that the IOLMs have made the biggest impact on those students who have traditionally struggled with the content. Although the sample for each year has been relatively small (n=36) we are hopeful that these results are scalable to much larger cohorts wishing to adopt this approach. From the qualitative data it can be safely concluded that there is a very high level of student satisfaction as they express their preference for learning in this interactive paradigm, rather than the more didactic methods characteristic of traditional higher education learning spaces. The use of learning technologies has enabled the creation of IOLMs that foster student and as a consequence, teacher engagement.

Crash Courses

Over the period 2008-2010 the CCs approach has been associated with some significant improvements in student performance. The average grade has increased from 47% in 2008 to 72% in 2010; at the same time the failure rate has decreased from 32% to 5%. There has also been broad agreement that students receive adequate feedback, as expressed through standardised learning and teaching evaluations, increasing from 18% to 81% over the same time period. This dramatic response seems to be related to the formative feedback strategy that has been adopted for lectures, as the final assessment is based on electronically marked MCQs which offer little along the lines of effective feedback. In addition, a special survey asking if students viewed CCs as improving their understanding of lecture material received 98% broad agreement. A sample of unsolicited student emails provides a more comprehensive understanding of the students' perception of the effectiveness of CCs, as seen in Table 2:

Table 2: Qualitative results for Crash Courses: Unsolicited emails.

Unsolicited student emails	• *The crash courses provide an overall understanding of what will be learned and the outcomes that are expected. This makes the process easier to grasp as there is already an understanding of the end result or goal. The notes taken from the crash course have been useful when undertaking homework questions to easily see what is required and the process in completing the question. (2010)* • *The crash courses have been invaluable this semester for consolidating my learning after lectures and in preparation for tests and the exam. They offer a succinct overview of each topic in the course that forms a strong framework to build upon in the lectures. They are incredibly useful as a method to review past lecture material or to get a head start on a topic and go into further detail in the lectures. The crash courses allow the topic to be presented in a relatively short amount of time, allowing extra time for further in-depth discussions and relevant examples. The use of the crash courses followed by these examples allow me to gain a much deeper understanding of each topic. (2011)*

Summary and recommendations

From our experiences, material prepared for traditional f2f lecture based courses does not need to be radically overhauled, but can be selectively and incrementally adapted to an EPLE approach using readily available and user friendly digital systems. At the same time, we see EPLE as the transformative tip-of-the-iceberg when it comes to facilitating broader change in our higher education learning and teaching practice. Paying attention to the design of the pre-lecture engagement using learning technologies that sustain a strong teacher presence and level of interactivity, has for us driven a change in the very nature of the lecture session itself. Lectures have now become more active, and more interactive, with much of the traditional lecture content now being delivered to students through other means. We believe this makes for richer and more effective use of the f2f sessions that create a culture of engagement through the use of technology and interactive learning.

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