

Creating a “Live Learning” environment to support high achieving distance students in Civil Engineering

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Structured abstract

BACKGROUND

More campuses than ever before are offering web based distance education programs. The current trends in information technology enhances these distance education (DL) programs through a number of new online delivery products, which increase the quality of the distance student learning experience. Recent literature has indicated that DL students do not perform as well as face-to-face (F2F) students, especially when part of a mixed mode course (F2F with DL). However, this paper describes how one instructor learned from her first used DL teaching experience and then successfully applied online delivery tools to create a learning environment where distance students not only passed the course, but achieved high marks at rates similar to face-to-face (F2F) students.

PURPOSE

Can technology be used to create a learning environment where distance students achieve high marks at rates similar to F2F students in a senior level civil engineering course?

DESIGN/METHOD

After reflecting on the first delivery of a course to DL students in 2010, the instructor redesigned the delivery of the course to DL students to include more “Live Learning” opportunities using web-based real-time communication tools. The redesign focused on creating more interactive learning experiences for DL students. Improvement is measured by comparing the distributions of the final grades of the DL and F2F students for terms 2010, 2011, 2012 and 2013. In addition, the rates of return of student feedback as well as student feedback ratings are compared. Qualitative measures such as typical distance student feedback and instructor observations are also reported.

RESULTS

Over the four terms of study, the F2F student grades seem to reach a stable distribution, while the DL student grade distribution moved toward an increasing proportion of high achieving students in later terms. Instructor observations indicate that DL students' participation in discussions also improved. Lastly, DL students' participation in the university course evaluation increased from 0% to 86%. Student satisfaction improved from 3.3 to 4.4 (out of 5) by 2013.

CONCLUSIONS

DL students are achieving at a higher level than in the previous terms. This change may be attributed to the instructor's more sophisticated use of web based interactive communication technology. Other possible causes for the improvement in achievement may be that DL students are becoming more adept at taking courses and/or the population of students who choose to take courses at a distance may be changing.

KEYWORDS

Distance learning, structural design, online learning facilitation

Introduction

Since the introduction of the higher education contribution scheme (HECS), many Australian students entering the university have resorted to working whilst learning. With a view to capturing the positive aspects of this trend, many universities have designed their respective undergraduate degree programs to be more flexible and offered in distance mode. One manner of providing flexibility is the offer of web based distance education programs. CQUniversity is one of the leading providers of distance education, offering approximately 100 degree programs. In the past, distance education programs were solely paper based and it was difficult for students to achieve high marks. With the advent of sophisticated online communication tools, distance students are at less of a disadvantage than in the past.

This paper describes how a final year structural design course in civil engineering was first offered as a distance course in 2010 and substantially improved in 2011 and 2012. Details of the course design are narrated for both distance learning (DL) and face to face (F2F) modes. A comparative analysis of the student engagement and the outcomes achieved in both modes over a four year period is presented.

Background

Central Queensland University (CQU) offers two unique degree pathways in engineering – one with a Co-op experience (the dual award program Bachelor of Engineering (Co-operative Education)/Diploma of Professional Practice (Bachelor of Co-op Engineering) (Jorgensen and Howard 2005) and one with Distance Education option, but no Co-op option (Bachelor of Engineering - BEng). Approximately 27 percent of the CQU enrolled engineering students (19 percent EFTSL) take their courses as part of the distance education program (CQU Enrolment Data). Both of the degree options integrate Project Based Learning (PBL) in all years of the degree program (Howard and Jorgensen 2006).

CQUniversity has offered engineering technology programs in distant mode since the late 1990s. In those early programs, paper study materials were posted to students and assessment submissions were also paper based (Martin & Devenish 2007). A review of the Bachelor of Engineering program in 2006 recognized that due to skills shortages, an increasing number of people already in employment were seeking to obtain engineering qualifications without having to leave their employment to become F2F students. As an outcome of this review, CQUniversity introduced a DL offering for the Bachelor of Engineering (BEng), with the first year courses being available in "Distant mode" in 2007 and the program was fully introduced at the senior year in 2010.

DL courses in the Bachelor of Engineering program were never paper based courses. Instead they utilized the university Learning Management System (LMS) (Dhanasekar & Devenish 2008). The students who choose the BEng distance program tend to be older and be currently employed in an engineering-related field. Their schedules tend to be quite different than F2F students because of their employment. Many engineering courses include a "residential school" week where distance students come to campus and participate in community building activities as well as begin team projects (Martin & Devenish 2007).

Sumner (2000) outlines three general historical categories of distance education in her critical analysis: correspondence study, multimedia distance education and computer-mediated distance education. Of these three, the third has the most potential to foster interactivity. Technology (print, radio, television, audio and video tapes and computers) can mediate the distance between the teacher and the learner. Some technologies are one-way (video tape, television, radio), while others are two-way (telephone, video conference, email). The third generation allows for more social learning and interactivity between learners.

A review of six Australian Universities (Mir and Rahaman 2007) showed that distance students tend to perform significantly worse in integrated courses that have both F2F and distance students. Distance students have higher attrition rates and can suffer from a sense

of isolation (Mir and Rahaman 2007). Since that time, more sophisticated and easier to use software is available to facilitate real-time interaction at a distance. In addition, students and instructors are more technologically capable of using such tools. This paper presents a case study for creating a good learning environment for final year distance civil engineering students.

Case study: Concrete Structures

"Concrete Structures" is a core design course for Civil Engineering students in their final year. In the F2F mode this course has weekly lecture, tutorial and laboratory sessions. Laboratory attendance is compulsory. In the laboratory sessions, students are asked to design a structural beam for the given condition using theoretical knowledge. They also study the behaviour of the beam when subjected to loads. DL students cannot attend weekly labs. Instead they have compulsory residential school as part of the course delivery. The DL students complete the laboratory component during residential school.

First distance offering - 2010

In 2010 this course was offered for the first time both in F2F and DL modes. As in all offerings of the course, most of the DL students were mature aged students and worked in industry as described by Martin & Devenish (2007). The Moodle learning management system (LMS) was newly available on campus and was used to provide weekly study materials on the course site, such as the weekly study guide, tutorial problems, and additional readings other than text book. In addition to the study materials, all F2F and DL students were invited to participate in course forum discussions. The instructor was available to all students via email and phone. All questions were answered within 24 hours and the instructor would follow-up with phone calls on an as needed basis. Videos of lectures were available to all students via the course site. However, only the F2F students could attend a live lecture and could meet with the lecturer in person if necessary. The compulsory residential school was offered during the ninth week of the 12 week term. The DL student time table was scheduled in a way so they could meet F2F students and also participate in activities with groups involving both the F2F and DL cohorts.

The instructor was unsatisfied with the performance and the poor course evaluation participation of the distant students. The instructor modified the next course offering.

Second distance offering – 2011

In the 2011 term, changes were made to the course delivery that focused on increasing student interaction with the instructor. The course was structured the same way as in the previous term. The only change to the course was the addition of "Live Learning" sessions. Live Learning sessions were introduced via WebEX (desktop sharing through web browser) for DL students. The 2-hour Live Learning sessions were conducted at 7:30pm once every other week, with additional sessions on an as needed basis. The 7:30pm time was chosen so that most DL students could arrange to have completed work and family commitments by that time. Live Learning sessions include various activities such as (re)teaching the content, discussing tutorial problems, clarifying any other course related content. The sessions also focused on encouraging and stimulating DL students to link their knowledge of industry practice and procedures to the theoretical knowledge presented in the course. But, probably the most important outcome from the Live Learning sessions was the development of community amongst the students and instructor.

The use of WebEX created an online classroom-like environment where DL students could see their classmates and the lecturer at the same time. The instructor observed a stronger sense of community was developed amongst the DL students after the inclusion of Live Learning sessions. The DL students participated more in discussion forums and they were more likely to approach the instructor with questions via email or phone. Given the successful implementation of the 2011 course, the same teaching approach was continued for the years 2012 and 2013.

Results & discussion

Improvement in student learning is measured by comparing the distributions of the final grades of the DL and F2F students for terms 2010, 2011, 2012 and 2013. In addition, the rates of return of student feedback and student satisfaction ratings are compared. Qualitative measures such as typical distance student feedback and instructor observations are also reported.

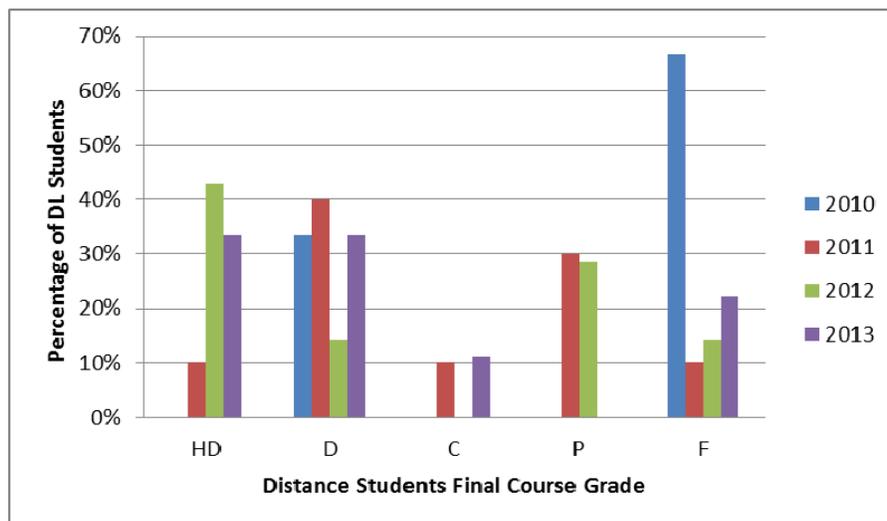
Table 1 summarises the number of students in each offering of the course, indicating how many students completed as well as how many students did not complete (withdrew) the course.

Table 1 Number of Students Completing or Withdrawing from 'Concrete Structures'

Term	Distance Students	Face to Face Students	Total
	Completed/Withdrawn	Completed/Withdrawn	Completed/Withdrawn
2010	3/1	26/0	29/1
2011	10/4	29/0	39/4
2012	7/1	17/2	24/3
2013	9/1	18/3	27/4

Quality of student learning

Figure 1 is a summary of the distance students (DL) grade distributions for the four terms (2010, 2012, 2012 and 2013), where HD – High Distinction, D – Distinction, C – Credit, P – Pass and F – Fail. During the first term the course was offered (2010) two of the three students (67%) failed the course and one (33%) earned the grade of D-Distinction. In each subsequent offering of the course, the grade distribution shifts away from failure (F) and toward high distinction (HD). This result indicates that students were more successful in subsequent offerings of the course (Terms 2011, 2012 and 2013).



**Figure 1. Grade distribution for all four DL Cohorts.
Terms 2010 (n=3), 2011 (n= 10), 2012 (n = 7), 2013 (n=9).**

Figure 2 is a summary of the face to face (F2F) grade distributions for the four terms (2010, 2011, 2012 and 2013). In general the shape of the grade distribution for these three terms remains stable.

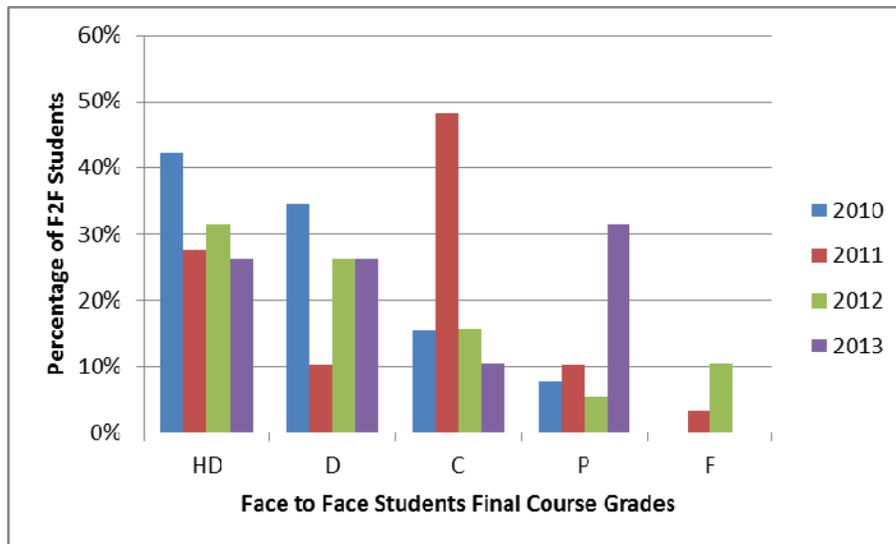


Figure 2. Grade distribution for all four F2F Cohorts Terms 2010 (n=26), 2011 (n= 29), 2012 (n = 17), and 2013 (n= 18).

Increase in high achieving DL students

Figure 3 summarises the proportion of students earning a grade of High Distinction or Distinction (HD or D) in both the F2F and DL student groups for each of the four terms of the study. By the third term, the proportions of high achievement are the virtually the same for both groups. This result shows that the DL students can be effective learners with very high levels of achievement. In 2013, the proportion of DL high achieving students is higher than the F2F students.

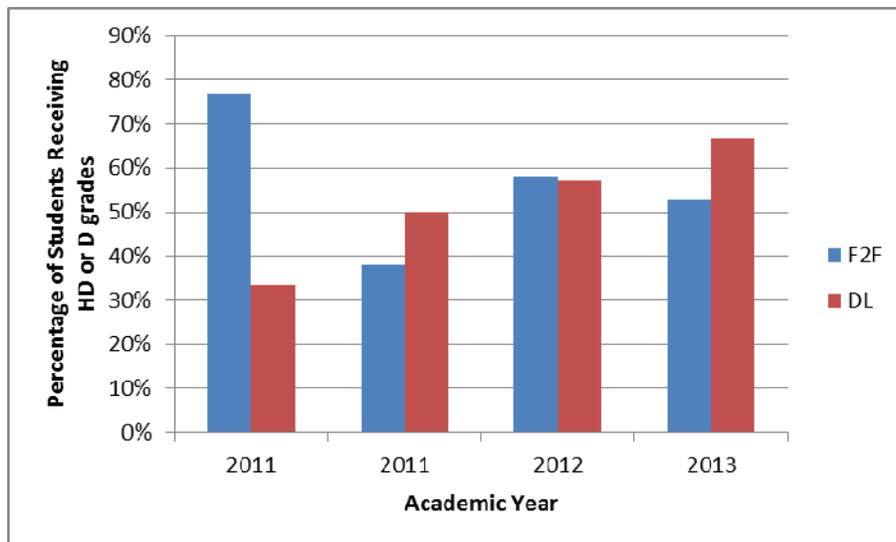


Figure 3. Proportion of DL and F2F students receiving an HD or D in Terms 2010, 2011, 2012 and 2013.

Student feedback

One measure of student engagement is the rate at which students submit student feedback. The first time the course was offered in distance mode (2010), the feedback rate was 0% from distance students despite several email and web-based communications from the university administration. In two years' time, distance student participation in feedback grew to 86% in 2012 and to 77% in 2013. The improvement in student feedback rates is an indication of the increased engagement of the DL students.

But more importantly, students' ratings and comments provide a measure of the quality of the course. Table 2 reports the overall student satisfaction for both the Concrete Structures course and for all engineering courses the same year. As seen in the table, student satisfaction increases each time the course is taught. In addition, the student satisfaction reaches the school average in 2012 and exceeds it in 2013.

Table 2. Average student satisfaction for the 'Concrete Structures' course (where 5 represents "strongly agree" with the statement "Overall, I was satisfied with the quality of this course).

Year	2010	2011	2012	2013
Concrete Structures Student satisfaction	Data not available	3.3	3.8	4.4
Student Satisfaction for all CQU engineering courses	Data not available	3.8	3.8	3.8

The data presented above maps well with qualitative comments presented below. These comments were made by the DL students during the years 2011, 2012, and 2013. (No data is available from 2010).

One theme was the availability of the lecturer and the online WebEx meetings:

'I thought Rema organised the course well, she was easily contactable and made good efforts to assist. The interactive online lectures were excellent - a good learning opportunity for flex students!!!' (2011 Student Comment)

'the lecturer was reasonable quick at getting back to you if you had any questions and was very approachable' (2011 Student Comment)

'Rema supplies good study notes and takes the time each week to supply an webex meeting for the external students' (2012 Student Comment)

'The best aspects of the course are the online tutorial lectures. The laboratory activities are also best aspects' (2012 Student Comment)

The comments above speak to the sense of belonging to a community of learners that the Live Learning sessions helped create in the class. The sense of community and confidence in the instructor's genuine desire to see all students succeed helped diminish the DL students' sense of isolation and helped motivate them to achieve highly.

Another theme in the student feedback was related to meeting the needs of DL students.

'Excellent lecturer and a really interesting course. Quite difficult for me to get my head around after having not studied or worked in this field for over 8 years but I learned heaps along the way - about concrete and how to study again.' (2011 Student Comment)

'The res school was well organised. To have been provided with a timetable of activities was greatly appreciated' (2011 Student Comment)

'Residential school for flex students very productive. One of best in comparison to previous years.' (2013 Student Comment)

Additional instructor effort

Creating a Live Learning environment for the DL students did require additional instructor effort in addition to the effort put forth for the traditional F2F students. The following list provides examples of additional effort put forth for DL students.

- The instructor recorded the lectures specifically for the DL students rather than just video tape F2F lectures. These tapes were available to all students once they were uploaded onto Moodle.

- In addition to having access to all course discussion forums, the DL students had their own forum for communication, which was monitored by the instructor as some messages were specific to DL students.
- Additional preparation and implementation time was required for the DL student Residential School.
- Additional emails and phone calls were made to struggling DL students, as the instructor would not see those students during F2F lectures.
- Live Learning sessions usually lasted 2 hours and occurred about every other week.

Study limitations

There are a number of limitations with this study. Using grades as measure of pedagogical improvement is problematic. While the assessment strategies remained constant through the years of the study, each year the course is taught, the instructor developed additional pedagogical knowledge which can be used to teach the course better each term. Another difficulty is that the academic characteristics of each student co-hort were not carefully controlled. The authors believe each group was similar to the others, but there is inherent variability in student cohorts of an average size of 30.

Conclusions

Although the data sets used in this study are limited and further research is essential, the authors offer these observations:

- (1) DL students can learn 'hard' science based structural design principles and practices equally well as their F2F counterparts, given a stimulating learning environment is provided in their online course structure.
- (2) DL students are as keen as the F2F students to achieve high distinction marks.
- (3) Due to their industry experience, DL students often have better opportunities to directly relate the theory to practice; DL instructors should leverage this knowledge so that DL students' experience can benefit F2F students through learning forums.

This paper reports the successful implementation of Live Learning sessions via WebEX to help distance learning students achieve high grades in a final year Civil Engineering course. The integration of Live Learning sessions created a greater sense of community amongst the students and a stronger relationship with the instructor so that distance students are achieving at a higher level than in the previous terms. This change in performance is attributable to the instructor's more sophisticated use of web based interactive communication technology. However, other possible causes for the improvement in achievement may be that DL students are becoming more adept at taking courses and/or the population of students who choose to take courses at a distance may be changing. Further research in these areas is suggested.

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