How a web conference classroom evolved into a distance learning classroom with live support

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Structured abstract

BACKGROUND
Hydrology and Erosion Management, part of the Bachelor of Engineering Technology (BEngTech) Degree, is taught flexibly within New Zealand. Flexible, by the BEngTech definition, refers to flexible space but fixed time; hence web conferencing is used to provide real time contact with students based at other tertiary institutes. Delivering a traditional lecture via web link exaggerates the weaknesses of the lecture format. Limited personal interaction with the tutor and with fellow students makes it challenging for students to stay engaged. Shifting the class focus to online activities, and requiring the students to do these within "web conferencing class time", created a virtual classroom where all students could be treated equally. The web conferencing tool therefore became secondary and was used to support the online activities through short periods of information and clarification.

PURPOSE
The purpose of this study is to produce a model of a successful flexible classroom that actively engages students with the learning outcomes, the tutor and each other and produces a positive learning experience for the students.

DESIGN
A questionnaire was developed in 2012 to ascertain how the teaching model suited the students and what improvements could be made. This small sample produced quantitative data on the students' perceptions of the web conferencing class. In 2013 the modified questionnaire was more qualitative and targeted, asking how the balance of activities, web conferencing and online work each aided the student to learn the course material.

Feedback from questionnaires was analysed in conjunction with student participation with the learning management system activities and the student results. The quality of students' answers to tutor-directed online activities reflected the depth of their learning. Initial conclusions were drawn between traditional styled lectures, traditionally styled web conference classes and this flexible classroom model based on the multiple data sets described above.

RESULTS
In 2012, anecdotal evidence showed students were positive about this model of learning experience, reducing common fears of how challenging learning in this type of environment might be. The feedback from 2013's cohort showed an improvement in engagement levels. This is likely to be as a result of increased tutor confidence and competence in using web conferencing and learning management software in conjunction with each other. Further, with experience, learning activity instructions have been improved to clarify expectations to suit the changed teaching environment. The learning environment has now transformed from a web conference direct transmission classroom into a virtual classroom through a learning management system with live support.

SUMMARY
With the removal of many of the barriers found in traditional web conferencing classrooms the students have expressed their appreciation of learning in this type of environment. As the online environment was a base for all sessions, the web conferencing aspect became of secondary focus allowing students the freedom to more easily interact online with the content, their peers and with the tutor.

KEYWORDS
Distance Delivery, Web Conferencing, Blended Delivery

Background

Reason for delivery

The Bachelor of Engineering Technology (BEngTech) is a collaborative degree taught within six institutes. As part of the common nature of the programme there is an expectation that courses with low numbers are taught flexibly where possible. Flexible, by this degree's definition, is where a class may be delivered in a fixed time but the space is flexible.

Web or video conferencing is the primary choice for flexible delivery. Courses taught in this manner may be hosted by three different institutes, in the civil and electrical engineering majors. For any course, students enrol within their home institute though delivery may be from another institute. If an institute receives a course from another institute then they will provide students with a 'mentor'. A mentor for this delivery is a staff member at the receiving institute who can support a student to develop understanding with the material. Mentors may not be experts in the delivered course, or be in class with the students at the same time. This model of delivery has similarities to that cited in Symonds, Hartnett and Brown, (2012) and Bower (2010).

Technology

Technology wise, Adobe Connect is the platform of choice for web conferencing delivery. Two other web conferencing platforms have been trialled in the past but Adobe Connect has provided the best experience for both the tutor and the students. Adobe Connect is a powerful tool that has been used successfully for a number of distance courses (Bower M. , 2011b). Adobe Connect provides an easy means to display information from presentations, the internet and course files, communicate to a number of students at once, whilst also providing an online whiteboard (that could be used collaboratively) and a chat function. The main drawbacks experienced as a teaching tool is a presentation delay of up to 5 seconds between sites. That is, the voiced instruction was instantaneous and the presentation would lag behind it. Other technological issues, from connectivity to audio feedback, also hinder the ability to teach and learn engineering in this environment.

A second important technological element is the learning management system (Moodle) which was used in conjunction with Adobe Connect. On any given week up to eight activities could be administered within Moodle and students are expected to contribute throughout the course. Students are required to do individual and group work in a number of online activities such as forum discussions, forum calculations, wiki development, and glossaries. Many tasks involved using Microsoft Excel to model river data, and forums were used by students to compare and contrast their answers. Moodle also held all presentations so the students could constantly review. Moodle was an important part of the web conferencing classroom (and as the title suggests became more important than the actual web conferencing as the semester progressed), as this Moodle environment held all the content and treated all students equally.

Blended delivery

Web conferencing is defined as a highly interactive, internet-based application with a rich collaboration feature set (Hyder, Kwinn, Miazga, & Murray, 2007). In an engineering sense it is generally perceived as a difficult mode of learning for the students, compared to a direct face to face class (Bourne, Harris, & Mayadas, 2005). A video (web) conferencing classroom in the past has tended to set up a passive learning environment of a didactic nature (Smyth & Zanetis, 2007). This restricts the already limited opportunities within a transmissive environment for personal interaction between a tutor and the fellow students hence making it challenging for a student to stay engaged (Pomales-García & Liu, 2006). Delivering the traditional engineering lecture via web conferencing exaggerates the weakness of the lecture format resulting in more likely disengagement by distant students. Bower, (2011a) provides three web conferenced teaching and learning examples, from tutor

directed to co-constructivism, with a final conclusion that the student centric approach is possible and also providing some initial design principles for an educator to adhere to whilst creating an online environment. Also, by having live students in the same classroom, it further alienates the distant students with the feeling that they have the hardest and slowest avenue for content support.

While the ability to web conference has become easier as tutors and receivers only need the most basic computer skills to set it up (Anonymous, 2005) the pedagogical knowledge with regard to learning through web conferencing and the different class structures that can be implemented is a recent development (Smyth & Zanetis, 2007). Bonk and Dennon (1999) quite rightly noted that the pedagogical knowledge will be more important than technological knowledge when teaching in this environment.

Bower (2011) makes the important point regarding technology: failure to understand one subtle feature of one of the many tools that could be used within the classroom (web conferencing software, learning management systems, not to mention teaching pedagogy) can have a devastating effect on the learning environment. This can make it an extremely difficult task for a tutor to start to teach in this environment with confidence (as well as for a student to learn with confidence). Also it is important to make sure there are strong links between the Adobe Connect class time and the online class time (Shannon & Francis, 2012), ensuring that there is sufficient support in both environments with seamless transitions.

Conversely, distant learning through a learning management system is better understood and is commonly utilised for self-motivated students that cannot make face to face classes. Though this may be the case, Bourne et al (2005) explain that engineering courses tend to lag behind other disciplines when it comes to online education, because of the reliance on mathematical foundations and the use of laboratories where students can practically use tools. As Bourne et al, (2005) continue, for online engineering education to be accepted, the quality must be comparable or better than the traditional classroom, courses should be available and accessible at any time by any number of learners and also cover all engineering disciplines. Other drawbacks in comparison to a traditional face to face classroom include motivation for students to complete activities, the lack of instant support with content, and the volume of material and tasks that are usually required to be completed by the student and then reviewed by the tutor in charge (Bonk & Dennen, 1999). The key to any mode of learning is student engagement and by ensuring tasks are relevant to students through either assessment, industry involvement or content knowledge will provide students with the drive to complete activities, and can be successful in a web conference environment (Ellingson & Notbohm, 2012; Bower M. , 2011b; Pomales-García & Liu, 2006; Quilter & Chester, 2001). Bower (2011a) and Barnes (2000) link web learning (online & web conferencing) to social constructivist theory noting the challenges to accommodate all the extra face to face interactions that are taken for granted within the classroom into an online format.

The Module: Hydrology and Erosion Management

Hydrology and Erosion Management is a level 6 paper which is part of the civil engineering programme, and is delivered from an Institute of Technology in New Zealand. There are three main assessments as part of this course: a main project worth 30 %, an assignment worth 20 % and an end of semester exam worth 50 %.

This course was taught for the first time in 2011 in an entirely face to face classroom and in the subsequent years in the above defined flexible manner. In 2012, students were enrolled from the Home Institute and one distance Institute while in 2013 a second distance Institute joined the web conferenced classroom.

Hydrology and Erosion Management's 2011 classroom environment was taught in four hours of face to face class time which was facilitated into a number of activities designed for students to collaborate to understand and produce work which met the learning outcomes.

The tutor's role in this classroom was as a facilitator, providing instruction for activities, providing content for the learning outcomes and helping students to understand the material. Lecture format was kept to a minimum in these classes, with direct instruction occurring only when needed. This resulted in approximately 60 minutes of instruction interspersed within four hours class time.

The desire for the web conference classroom was to keep a similar format. Students would work collaboratively at their home institutions and then come together as an online group to share and discuss. All activities were created, and administered within Moodle, complete with instructions (Figure 1). Instructions were embedded within the presentation as well to provide clear links between the web conferencing software Adobe Connect, Moodle and the tutor.

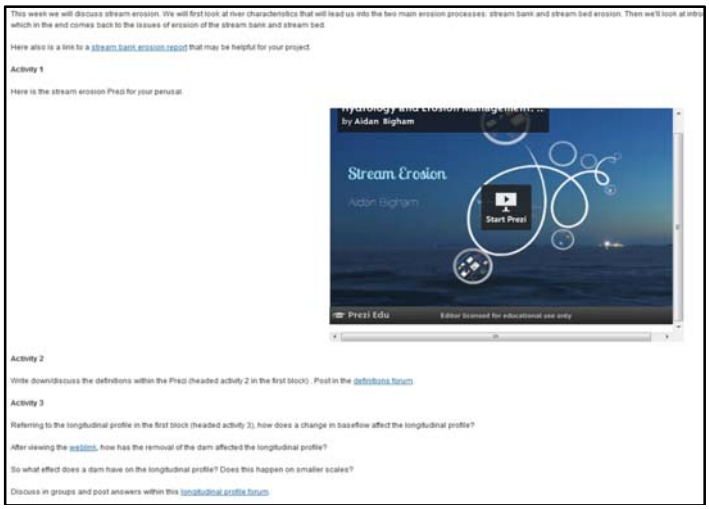

Figure 1: An extract of a Moodle page

The Adobe Connect software (Figure 2) was used to transmit content and clarify instructions that were online. Web conference software was not used to 'interact' with the students through visual or auditory two-way communication. Any two-way interaction was expected in the online environment, either through Moodle or if there was a question, through the text based chat function of Adobe Connect. The home institution students would physically attend the web conferencing session, but were expected to use the online systems to interact; their questions always asked via Moodle or Adobe Connect.

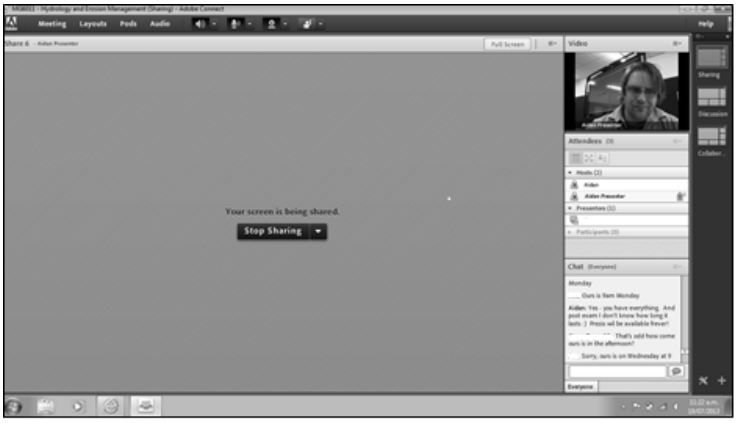

Figure 2: Adobe Connect system set-up for delivery

In 2012 class time was converted into two hours of web conference facilitation and two hours directed online work. The 2012 cohort believed that two hours of activities within the classroom was not enough and this was increased to three hours in 2013 with one hour of online work expected. This online time's original purpose was to limit the amount of web conferencing as it was perceived that this would be a difficult mode to learn and teach in. Hence activities created for this hour were for the student to reflect on what was learnt throughout the lesson or to prepare for the following lesson or a mixture of both.

This current model will continue into 2014 delivery.

Methodology

To test the effectiveness of the classroom, quantitative and qualitative data was collected in 2012 and 2013. This data from students included an online forum in the first lesson asking students for their initial fears learning in this flexible delivery format as well as a more formal questionnaire at the end of the course for students to reflect on how the style of delivery suited them.

Initial fears from 2012 and 2013 can be grouped into the following four areas:

- The paperless approach of the learning environment hence the perceived loss of information for the student
- Allocating time appropriately for each task inside and outside of class
- The learning connection between student and tutor or student and student at different institutes
- Reliability of the technology.

These four themes are similar to those that have been cited in Pomales-García & Liu, (2006) as perceptions towards the disadvantages of web based delivery from undergraduate engineering students.

The 2012 end of course survey had the main purpose to improve the delivery method. The general feedback from the students was that they enjoyed the style of delivery but would have liked more time within the classroom environment to achieve the online work that was given. Students also fed back that calculation work was difficult through the web conferencing format as well as the use of Microsoft Excel for hydrograph development and flood routing. For 2013 delivery, these main concerns were addressed. Class time was extended to three hours and online time reduced to one hour. In response to 2012 feedback, calculations and Microsoft Excel work were demonstrated differently, with more support put in place for 2013. Further support with online videos will be put in place for 2014.

In 2013 the end of course survey asked students for feedback on the course but became more targeted, asking how the balance of activities, web conferencing and online work each aided the student to be able to learn the content of the course. The survey was conducted online and anonymously to encourage students for open and honest answers.

This feedback was analysed in conjunction with each student cohorts' participation with Moodle (directed and self-directed learning). The quality of the online work, while subjective in nature, reflected the students' involvement with the material and hence the depth of the learning. These factors were correlated with the students final exam mark.

Student results are also compared, from the initial 2011 face to face class, to the web conferencing class as well as between distance students and the students that were on site to observe any discernible differences between the different cohorts.

Results

Student marks

A breakdown of internal and external marks for each year can be seen in Table 1. Internal assessment is created by the tutor and is moderated within the institute. External marks relate to the exam, which may or may not be written by the tutor (in this case it is) and is moderated outside of the institute.

Table 1: Average marks for each year's cohort, all students

	2011 Cohort Face to face only	2012 Cohort Web conference and face to face	2013 Cohort Web conference and face to face
Average of Internal Out of 50	38.44	35.02	36.32
Average of External Out of 50	31.56	26.86	32.29
Average of Total Out of 100	70.00	61.88	68.61

The 2011 cohort shows high marks in the initial delivery for the 2011 year. This is likely to result from the first time this course being offered so the class had very few students, hence there was much tutor support per student.

In 2012 the average marks dropped in both the internal and external marks. These marks compare well with other civil engineering papers taught in the traditional classroom environment at the home institute. A large difference to the final exam mark in 2013 can be seen and is likely to be related to the small change in teaching format from 2012. The student's final exam mark increased by 12 % from 2012.

The exam in 2012 and 2013 was moderated by Distance Institute 1.

Table 2: In class student results versus distance students (2012, 2013 combined)

	Home Institute Cohorts	Distance Institute Cohorts
Average of Internal Out of 50	34.32	37.71
Average of External Out of 50	27.63	32.15
Average of Total Out of 100	61.94	69.86

An interesting development is comparing the distance students' marks with the in-class students' marks. Table 2 shows that average marks are higher for the distance students than the home institute students, for both internal and external results. Breaking this up further, Table 3 shows that 2013 distance students improved markedly from the 2012 results in the external exam. Internal marks have stayed consistent between years. Table 4 shows the 2013 Hydrology class averages compared to two other web conference courses (named Flexible 1 and Flexible 2), within this degree.

Table 3: 2012 Distance student marks versus 2013 distance students marks

	Distance 2012	Distance 2013
Average of Internal Out of 50	37.28	37.99

Average of External Out of 50	28.25	34.75
Average of Total Out of 100	65.53	72.74

Table 4: Comparison in 2013 marks with two other flexibly delivered courses. All courses had a similar number of students

	Flexible 1 2013	Flexible 2 2013	Hydrology 2013
Average Final Mark 100	57.16	66.53	68.61
Average Home 100	58.99	71.25	61.94
Average Distance 100	56.10	62.98	69.86

Flexible 1 home students only slightly outperformed distance students, while in flexible 2, home students outperformed distance students by about 8 %. In Hydrology, the distance students outperformed the home students by 8 %.

Student Participation

Table 5: Engagement with Moodle 2013

Students	Percentage engagement
Home students	41 %
Distance students	59 %

Table 5 shows the percentage of written engagement on the Moodle site of the distant students compared to the home students. There was the same number of students learning at distance (n = 6) as there were directly in class. There is an indication that the majority of the distance students engaged with the Moodle site more than the home institute students, which means that these students interacted with the content more.

Student survey results 2013

Students were asked their perceptions on the conferenced delivery at the end of the 2013 module. A summary of the questions and main results follow.

How did the style of this course address your concerns about studying in a web conferenced format?

- Resources made it easy to communicate to lecturer and other students. For example, Moodle forums and Adobe Connect chat
- Fast paced, organised, and all resources are there to recap for study notes later on

Which is the best teaching option for this course and why?

- 83 % chose current method (3 hours web conferenced and 1 hour directed online) with the reason that it worked well and the one hour helps to finish off tasks or prepare for next lesson
- 17 % chose 2 hours in class and 2 hours online, because it gave more flexibility

How did the style of delivery help you learn in this course?

- The activities, resources, and assignments provided excellent opportunities to further develop what was taught in class

- The web conferencing technique allowed us to communicate directly to the tutor or fellow students. If we had a question not only the tutor would answer but other students would too
- Moodle layout was well organised and easy to find information and we knew what we were doing long before we had to do it
- Prezi gave the lesson a flow feeling and the links between prezi and activities were easily absorbed
- The tasks are like “homework” but forced to do it as its class time. You can’t beat learning by doing. I learnt a lot and in detail
- Hate the homework load

Have you taken part in other video conferenced courses before and what if so, what differences/similarities existed?

- Three students said yes that they had taken part in a video conferenced course previously
- I was overwhelmed and withdrew from the course early on
- Previous VC course was more individual rather than team effort where in the real world people must communicate. Also we could go 15 minutes without being acknowledged, which made it hard to attribute question to scenario. This did not happen in this course because of constant scanning of questions
- Both were all good

Discussion

Only initial comparisons can be drawn between the results as this flexible delivery is a new initiative as part of the BEngTech degree. Web conferencing classrooms have been delivered in 2012 and 2013. This provides a small sample with which to compare and contrast.

Results from Table 1 show a decrease in marks in the web conferenced environment in 2012 before marks increased again in 2013. The successful results of the 2012 and 2013 delivery show that the student centric learning within the web conferencing was possible and that the model of using Moodle for all interaction worked well. By using 2012 student feedback the tutor was able to further support students in using Microsoft Excel with river data and other calculations.

Table 2 (and Table 3) shows a clear difference between external exam marks of home institute students and distance students. Distance students consistently outperformed the home institute students. The distance students engaged with the online material outside of class time much more readily, as they are forced to, while the home institute students would turn up to class and engage online in class but would not engage as much outside. This means the distance students developed a deeper understanding of topics which was evidenced within their forum posts. Table 2’s results show that the structure of this course has inadvertently shown more needs to be done to relay the importance of the online tasks to the home institute students.

Table 4 shows a comparison of three courses taught in 2013 by web conferenced delivery. All courses have a similar number of students and this small sample shows that in the more traditional web conferenced classroom the home institute students outperformed the distance students, as is usually expected in this mode of delivery. Hydrology and Erosion management reversed this trend, as the distance students placed far more emphasis on engaging with the online material than the home institute students did (as shown in table 5) which would have resulted in the distance students receiving better results. Shannon and Francis (2012) provide a study which concurs with these results, where students that engaged in online activities in a blended environment received better outcomes than those students that did not. As a further example, one distance student did not show any written engagement online (but the nature of the group online activities meant that this student will

have been interacting through a colleagues posts) but this student's interaction further supported the theory that those that engaged online, understood the content more, and hence got a better result.

From the 2013 student survey the comments were very positive. The only negative comment was the homework load was too much, which is counteracted by another student saying that the tasks were like homework but done in class.

Students enjoyed the positive online environment and felt they had peer support as well as tutor support. This is one advantage that this model has over traditional web conferencing classrooms.

Students enjoyed the activities which they were asked to complete, as they saw relevance between the tasks, the learning outcomes of the course and industry requirements. They noted in the survey that communication was important in any working role and that this course helped them to communicate with students at their own institutes as well as with students in other institutes. Students found this valuable. During the course many activities relied on the students working together on postings, or moderating other postings; this created confidence in posting into the online environment as the course progressed. This correlates well with examples cited within Bower (2011a) and Bonk & Dennen (1999), where students who had active involvement with the course material took greater ownership of their learning, and developed higher levels of cognitive skills.

One student stated that they had learnt a lot and in depth. The nature of the activities were to encourage investigation and discussion of topics within learning outcomes which meant students could take a subject and learn it to their chosen depth. The depth for all students became the depth the most interested student wanted to take it. Hence each student brought different interests into the course; therefore it wasn't the same student defining the depth each week. Where more depth may have been needed, the tutor would contribute to the content within the online discussions and activities or add more depth through the web conferencing during class time. As Laurillard (2002) advocates, this discourse helps the tutor to understand the learning needs of the students and to adjust the lesson according to acquired student knowledge.

The student survey coupled with the class results showed that all students were well supported in this classroom and could all enjoy the student centric approach of this web conferenced classroom.

The Hydrology student's comments relate positively to the best practice for a web conference classroom (Hyder, Kwinn, Miazga, & Murray, 2007). Hyder et al state that the greatest advantage of web conferencing is the ability to present in a number of ways, solicit feedback and to provide clarification. Hence the tutor facilitated learner practice and then encouraged collaborative problem solving. There are papers that have shown that deeper learning does occur for distance students over web conferencing when the mix between student centric activities and web conferencing is right (See for example, Quilter & Chester, 2001; Ellingson & Notbohm, 2012, Smyth & Zanetis, 2007; Bower, 2011a), and this can be seen clearly within this Hydrology course too.

Conclusion

Web conferencing is seen as inferior to the more traditional engineering teaching transmissive face to face classroom or the student centric classroom. Because of the technological limitations, it is generally thought to be difficult to create a student centric classroom within a live web conferencing environment. This paper provides evidence to suggest a student centric web conferencing classroom is possible through the means of implementing a learning management system (Moodle) to be used in real time. As learning progressed, it was seen that the classroom relied upon Moodle more than it relied upon the conferencing software. The web conferencing was used in short bursts during a session to introduce content, clarify instructions or to answer questions. The class would not have

worked as well without either (Moodle or Adobe Connect) though the importance of each changed as the semester progressed. An interesting development was the consistently increased marks in external exams from the distance students. This is as a result of much greater involvement with the online course material. Initial thoughts were the use of Moodle would create an equal classroom environment between the home and distance students; however, the results suggested it favoured the distance students more.

A major limitation of the study is the size of the classroom, with a total of 12 students each year (2012 and 2013). This mode of delivery has the ability to work in larger classrooms but has not been trialled as of yet. Further study will compare developments when larger classes eventuate. Another limitation is the small sample of web conferenced flexible courses to compare. With further study and comparison more conclusions will be able to be drawn regarding flexible learning environments that students prefer to be in.

Further studies will also involve regular surveys as to how this class can work better for the students. Results have been compared between this environment and other distance courses in the same BEngTech degree but in a different specialisation. While initial comparisons are favourable more in depth comparisons between this model of delivery with more traditional web conferencing delivery would help to show the benefits of this student centric approach.

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