Increasing online lecture engagement- assessment of distance education technologies for providing in-lecture interactions

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uImagine Distance Education Innovation Grant Scheme 2015-2016 Final Report

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Part 1. Achievements statement

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Student engagement in recorded lectures and tutorials is a key concern for many online courses. Generally, online students perform just as well as internal students, however, many studies have found that students often display a poorer retention rate which may suggest something is lacking in our ability to engage them. As a result, CSU has identified online student retention as a core objective in many learning and teaching plans. This project aims to focus on this need for further engagement of online students through investigation of new and improved technologies that can provide in-lecture questioning or audience response systems for F2F students. In order to achieve this a two stage project was developed, where 1) a focus group was used to trial four different technologies and 2) a selection of these technologies were introduced into the teaching of subjects. A mixture of closed and open ended responses as well as focus group discussions were used to elucidate students perception of these technologies and the potential for them to increase engagement and if students felt they required more engagement. Site usage data (such as the number of views or attempts) was also used to understand the uptake of the changes to subjects. The key findings of this work included 1) students preferred technologies that they were already familiar with and that allowed a more seamless integration 2) students were craving more engagement in their lectures both internally and online 3) technology had to be used well to ensure students would not become disengaged. The below figure summaries the need for better engagement, the benefits of using these technologies and some of the issues encountered in the technologies trialled and this is presented through student comments obtained in this study.

Key documentation for this project is can be found at the below website. This includes a number of resources on how you can use Adobe Connect and i2 to deliver in-lecture questions. Including a pedagogical framework for its introduction and examples of how it can be integrated with technologies available at CSU (Adobe Connect and blackboard). You can also request assistance in building this activity through a DSL service request.

Resources: https://uimagine.edu.au/portfolio/engagement-in-online-lectures/

PROBLEM

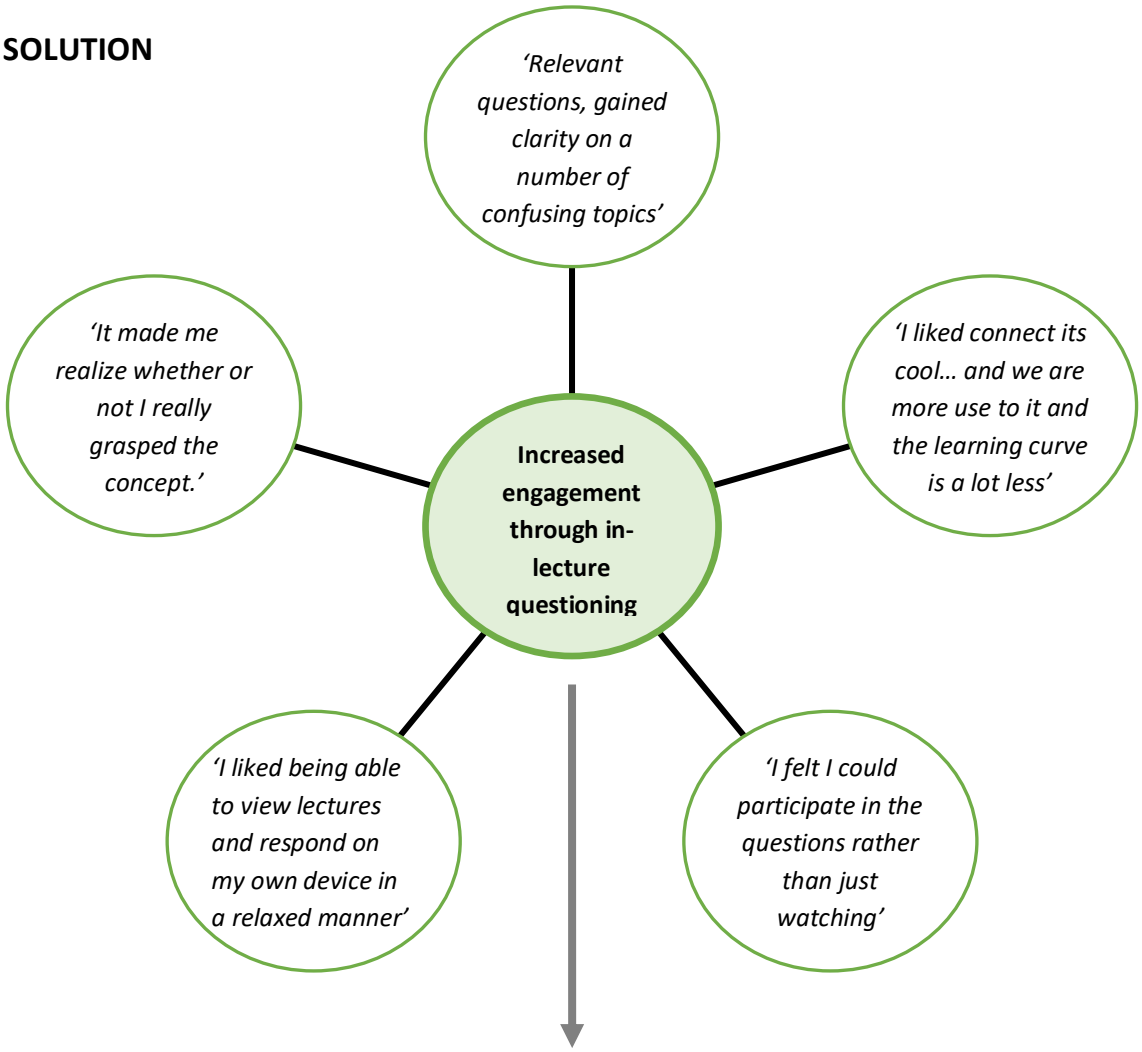
WHY SHOULD WE INCREASE ENGAGEMENT?

'I'm not sure why it is, but the further I get through the degree, the less interactive the subjects become.'

'Any way that DE students are able to respond to questions in a lectures is desirable.'

'In a lot of my lectures its just like watching them talk and I think you sort of switch of really quickly.'

SOLUTION



THE WAY FORWARD

TAKE ON FEEDBACK AND IMPROVE ACTIVITY FURTHER

'I'd like better integration otherwise I will stick to the normal lectures'

'Having to open another screen. Using the app was ok, but much of the info was missing'

'The other thing is with every lecture, every subject I have, almost use a different technology'

Part 2. Executive Summary

Student engagement in recorded lectures and tutorials is a key concern for many online courses. Generally, online students perform just as well as internal students however, many studies have found that students often display a poorer retention rate which may suggest something is lacking in our ability to engage them. As a result, CSU has identified online student retention as a core objective in many learning and teaching plans.

In-lecture question activities utilising clickers or audience response systems have been used widely over the past few decades to improve student engagement and learning in classroom environments. Studies on the use of clickers in tertiary education have received mixed reviews but in general with correct design, application and feedback they are considered to be beneficial for learning in many circumstances. Recent studies have found that in-lecture questions are positively received by a large class of multi modal students at CSU, even by online students who rely just on lecture. However, technologies now exist that allow this experience of in to stretch beyond the class room to students on other campuses and those viewing online lecture recordings.

This project investigates a range of new and improved technologies that can offer in-lecture questioning for students studying online. In order to achieve this a two stage project was developed, where 1) a focus group was used to trial four different technologies and 2) a selection of these technologies were introduced into the teaching of subjects. A mixture of closed and open ended responses as well as focus group discussions were used to elucidate students perception of these technologies and the potential for them to increase engagement and if students felt they required more engagement.

The overall aim of this study was to explore the use and application of in-lecture questioning to improve student engagement in recorded lectures for distance education students. The key objectives of this project were to:

1. Investigate face to face (F2F) and DE student perceptions of the use of in-lecture questions for improving engagement and learning
2. Determine which tool/s out of Blackboard, Echo360, Adobe Connect and Turning technologies is best to deliver in-lecture questions to distance education students at CSU
3. Develop a pedagogical framework and optimum feedback mechanisms to deliver in-lecture questions and increase student engagement
4. Disseminate results and offer professional development into potential methods of using in-lecture questioning to improve engagement to staff of CSU.

The key findings of this work included 1) students preferred technologies that they were already familiar with and that allowed a more seamless integration 2) students were keen for more engagement in their lectures both internally and online 3) technology had to be used well to ensure students would not become disengaged. The majority of students in the focus group preferred Adobe Connect with Quiz Connect as it was in a platform they were used to. It also offered better integration with video resources and interactions through quizzes were possible within the same recording. This technology was also well received in subject trials, with the number of students accessing the recordings doubling after in-lecture questions were added using Quiz Connect. However, like all technologies there were a few issues around how the program operated (including questions moving too fast and the text size was too small).

Key documentation produced as a result of this subject include instructions on how to use Adobe Connect (with Quiz Connect) and Interact2 (i2 with Blackboard) to provide in-lecture questions as a

way of improving engagement in-lectures. Additionally, resources outlining the pedagogical framework and the need for scaffolding, effective feedback and overall design considerations will be produced. These resources will be accompanied by video resources aimed at publicising the need for improved engagement and also to provide exemplars for better educational practice. It is also expected that the outcomes of this project will be linked and directly applied in the CSU online learning model scale up and collaboration have commenced in this space. The data from this project will also be published in peer reviewed journals in 2016/2017.

Overall, both internal and online students perceived significant benefits for their educational experience due to the increased engagement offered by in-lecture questions. However, the more streamlined and integrated the technology the better it was received by the students. Students also picked up on the pedagogical importance of appropriate feedback and scaffolding in ensuring the optimal engagement, further emphasising the importance of the educational design over the specific technology that is used.

Part 3. Detailed report

3.1 Context

Student engagement is a core aspect in the retention of students in a course and this is especially so for those offered through online or distance education (Clauson *et al.*, 2011). Possibly the most widely used tool to deliver content to online students is through the use of recorded lectures. This method is also used by many internal students who can't or chose not to attend lectures in person. Literature comparing online or DE against more traditional face to face (F2F) education is reasonably in depth, but divided (Driscoll *et al.*, 2012). However, much of the consensus is that the online students perform just as well as the F2F students, but instructor/ tutor presence and interaction can affect this (Richardson, 2005; Driscoll *et al.*, 2012). Despite the apparent effective learning achieved through online education, students often display a poorer retention rate and interaction with online students may suggest something is lacking in our ability to engage them. As a result, CSU has identified online student retention as a core objective in many learning and teaching plans. This project aims to address the need for further engagement of online students through investigation of educational technologies that can provide in-lecture questioning.

Clickers or audience response systems have been used widely over the past few decades to improve student engagement and learning in classroom environments (Banks 2006; Morgan 2008). Studies on the use of clickers in tertiary education have received mixed reviews but in general with correct design, application and feedback they are considered to be beneficial for learning in many circumstances (Morgan 2008). Recent studies (Miles and Soares da Costa, 2016) have found that in-lecture questions are positively received by a large class of multi modal students at CSU, even by online students who rely on the recordings. However, technologies now exist that allow this experience of in-lecture questioning to stretch beyond the classroom to students on other campuses and online. The key here being the ability to provide a similar experience to F2F students while also identifying issues which may require more specific, detailed or extended feedback (beyond that which is given in class). This is especially important as the development of understanding of some concepts may differ between online and F2F students due to differences in learning/teaching style or the progress of other learning activities (e.g. timing of practical sessions/ residential schools).

There are a number of reported difficulties associated with examining the impact of audience response systems in class room environments (Addison *et al.*, 2009). However, as the current project aims to increase student engagement and retention in online students, assessing student attitudes and perceptions of this activity should provide valuable information for integration into other subjects. This is particularly critical as in-lecture questions generally work on a student-centred pedagogical approach and it is this aspect that the current project will target.

The overall aim of this study is to explore the use and application of in-lecture questioning to improve student engagement in recorded lectures for distance education students.
The key objectives of this project are to:

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2) Determine which tool/s out of Blackboard, Echo360, Adobe Connect and Turning technologies is best to deliver in-lecture questions to online students at CSU
3) Develop a pedagogical framework and optimum feedback mechanisms to deliver in-lecture questions and increase student engagement
4) Disseminate results and offer professional development into potential methods of using in-lecture questioning to improve engagement to staff of CSU.

3.2 Approach

There were four key stages to this project, with details of each stage including any issues provided below:

1) Ethics approval. There were a number of delays in receiving ethics approval. This included delaying submitting the initial ethics approval until after CSUed in 2015.This allowed any feedback or discussion to be incorporated into the project at an early stage. Delays also occurred as some revisions were required to the ethics application
2) Focus group study. It was initially hoped that the focus group would have been completed before CSUed 2015 but a delay in the start of the project meant this was not possible. However, this did allow discussions to occur at CSUed which improved the project. The focus group study was also delayed due to issues with ethics approval and in organising enough participants for the study.
3) In subject trials. These were always planned for the 201630 session. However, to ensure the focus group could inform the technologies used in subject, these were delayed until the second half of the session. This also allowed issues around subject coordinators to be resolved and one of the three subjects was removed from the trial due to a change in staffing. This proved to be advantageous as the workload required for two large subjects was higher than anticipated. These trials were completed according to the original schedule.
4) Reporting and resource production. The reporting for this project will meet the appropriate deadlines. However, resources have not been finalised as they continue to evolve in collaboration with OLM specialists educational designers (ED's). Production of these resources and related professional development (PD) will still remain with in the time frame for dissemination of results (by November 2016) as CSUed is not being held this year.

3.3 Outcomes

The key outputs of this project are:

- Reports and other documents outlining the results and impacts of the technologies used to increased lecture engagement in both focus group and two science subjects. Results of this project will be published in peer reviewed articles in 2016/2017.
- Construction of a mini web site that will house all related resources for this project. This will be linked to the relevant sections of the OLM website.
- Targeted improvement to engagement in online recordings for two large service teaching subjects in the School of Biomedical Sciences (BCM210, BCM211, BCM411, DOH231 and BMS129).
- Incorporation of findings into various forms of PD. Including website, OLM and other DSL workshops. Preliminary information also presented at CSUed 2015.
- Useful contribution to licence renewals for Adobe Connect and CSUreplay.
- Contribution to the CSU narrative for flexibility and engagement under the banner of online learning.

3.4 Evaluation and impact

3.4.1 Evaluation/ Methods

In order to investigate engagement of educational technologies for providing in-class questioning a two stage approach was used which included an initial focus group trial of 4 technologies which informed later trials of two technologies in two service teaching subjects in the School of Biomedical Sciences at CSU.

Focus group trial

The primary method of data collection for the students' perspectives on the use of the technologies was a focus group trial of I2 (Blackboard), Adobe Connect (with Quiz Connect add on), Echo360 active learning platform and Turning technologies and the new (see Appendix B). Volunteer student participants from the focus group trials were recruited using posters/ information sheets placed around CSU campuses and students were offered a voucher as an incentive for their participation. Two focus groups were conducted simultaneously at Wagga Wagga and Orange campuses with some interaction occurring between the 2 groups. This allowed testing of synchronous and asynchronous activities. The session ran for 3hrs which included trialling the technology in a short simulated lecture before completing an online survey and then being part of a focus group discussion.

While the focus group protocol acted as a guide, the questions were flexible to represent the emergent nature of the conversation. The focus group interviews were recorded and later transcribed verbatim. Additional non-verbal behaviours identified during the focus group were also noted, such as head nodding, smiles, frowns or signs of boredom. These behaviours were aligned with the transcription where appropriate. Additionally, other notes about participant statements were written down in order to assist in making connections between the discussion and research question. As the primary goal was to investigate the participants' in-depth perspectives and experiences with technologies a common qualitative approach was used, which involved the transcripts being read several times to identify key themes, categories and interconnections. The qualitative data were analysed manually (thematic analysis) and this was aided through the use of Leximancer computer software. Leximancer is increasingly being used as a data analysis tool for qualitative data due to its ability to identify core concepts within the data and then illustrate how they are related. The output produced by Leximancer provides a visual representation of themes or concept groups in text data, representing the clustering of key words. This method of combining the concept analysis tool Leximancer and thematic analysis has been utilised by researchers in the past (Johns and McNamara, 2014). The identified key themes are then supported with example quotes to illustrate the findings.

In subject trial

In-lecture questioning was integrated into two large subjects offered through the School of Biomedical Science in 2016. This included two multi course service teaching subjects Physiological Sciences 1 (BMS129) and Foundations of Biochemistry (BCM210, BCM211, BCM411, DOH231).

Physiological Sciences 1 is a large first year subject with enrolments for 2016 at 210 students consisting of 100 internal and 110 external students. Three hours of lectures are delivered for this subject each week and these have been chunked into three separate one hour sessions and this includes some general questions at the end of the class which aid in students assessing their understanding of content. These lectures were supported by weekly night time revision lectures/ tutorials conducted in Adobe Connect which were typically conducted over 90 mins. Due to the length of these sessions, these were targeted as an area of the subject that could have improved engagement. As the session where conducted through Adobe Connect, the Quiz Connect add on (see http://www.adobe.com/products/adobeconnect/apps/quiz-connect.html) was utilised in the final 5 weeks of session. The key advantage of this tool is that function of the quiz was identical for both internal and DE students watching the recording. This tools provides questions in quick succession and the quicker the question is answered the higher the mark.

In Foundations of Biochemistry, in-lecture questions were integrated into the two hour long face to face lectures that comprised the non-laboratory component of the Foundations of Biochemistry subject at CSU. Both online and internal cohorts contained a mix of students from a variety of majors

including biomedical, dentistry and veterinary science. In-class questions were administered through clicker devices and software supplied by Turning Technologies (http://www.turningtechnologies.com/). The system allows integration with PowerPoint so that questions can be presented within a prepared PowerPoint presentation during the lecture. A variety of questions were used in each lecture and these were generally multiple choice questions used in past exams and which related to the topic being delivered in that lecture or as revision for previous lectures. The results were displayed immediately within PowerPoint during the lecture to allow students and the instructor to assess comprehension of the material. The instructor would then provide additional explanation of any poorly understood material. The standard practice for DE students is to provide a recording of this lecture, including clicker questions and feedback via Echo360 (http://echo360.com/). The recordings consist of screen capture of the lecture slides (including clicker questions, responses and feedback), audio from the lectern microphone and a small inset of a webcam capturing the lecturer. In order to make this experience more interactive for students, these recordings were edited down to remove breaks, time for questions and other delays (typically 40% of the time removed) and when needed a screen was put in place to direct students to the quizzes that had been duplicated in i2 (Blackboard). This included reference to the mobile app and the location of the quiz. The key advantage here was that the quizzes were mobile compatible so students could complete the quiz on a mobile device while watching the recording on their computer. The learning analytics for these test were then regularly checked by the academic and/ or support staff and any questions which were responded to poorly (and differently to internal students) were identified and additional feedback supplied through i2 (Blackboard) announcements, discussion boards or via short video recordings embedded into the site.

In Physiological Science 1 the uptake and completion of the Quiz Connect were investigated through the number of accesses (and repeat access) to the recordings. This data was achieved through the analytics dashboards available in Blackboard and Adobe Connect. The uptake of in-class questioning for Biochemistry was explored through the number of CSUreplay and YouTube views as well as looking at the analytics around tests in Blackboard (including the number of attempts).

In order to examine student attitudes to the technologies examined a survey monkey was added to the site at the end of the session. A list of the questions can be found in Appendix C. Results for closed questions are represented as the mean ±stand error (SE) of the values attributed to responses from the Likert scale (5 for strong agreement down to 0 for strongly disagree). The difference between two means (internal and DE) were compared using ANOVA's in SPSS (Version 20, SPSS Inc, Chicago, IL). Differences of $P < 0.05$ were regarded as statistically different. Open ended responses were explored using a manual thematic analysis and included the use of word trees (in Nvivo) to aid in identifying themes and patterns in the comments and this was followed by a process of review, revision and grouping/ regrouping into themes. Examples of student comments associated with the key themes are provided. This method was selected as it is suitable for small qualitative data sets and allows a more in-depth analysis of the data (Denzin and Lincoln, 2008).

3.4.2 Results and Impact

Focus group

The focus groups consisted of six participants in both Wagga Wagga and Orange campuses and all participants (n= 12) were students at Charles Sturt University. Of the 4 technologies trialled for in-lecture questions, Adobe Connect incorporating Quiz Connect was ranked the highest by participants (Figure 1), with 67% of participants ranking it as number one. Adobe Connect consistently received stronger ratings in relation to the ease of use, but there was no significant difference in the scores between the four technologies. The majority of students used the university wifi during the session with 2 participants needing to use both wifi and their own data to respond to in-lecture questions,

with the later participants reporting they had issues connecting their device to university wifi for some of the session.

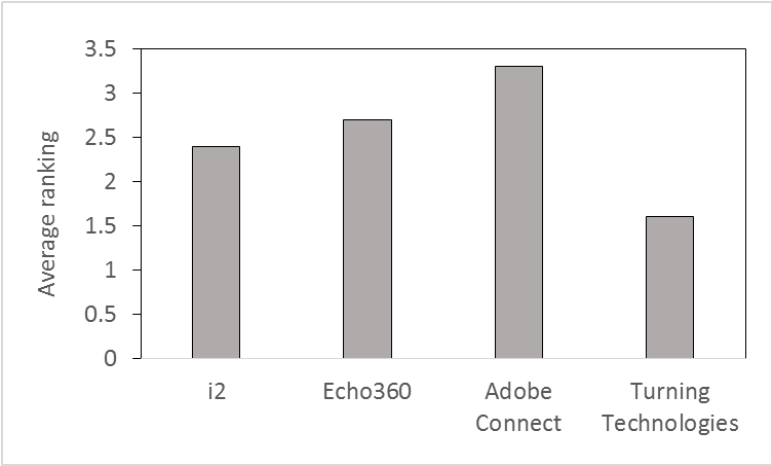

Figure 1. Ranking results for the 4 technologies trialled in this study. Data from Survey Monkey where the average ranking for each answer choice is calculated so you can determine which answer choice was most preferred overall. The answer choice with the largest average ranking is the most preferred choice.

The strongest relevance of concepts from the Leximancer analysis were the words "Connect" (100%), "Use" (62%) and "work" (52%). The elucidation from the narrative was attributed as the "use" of "Connect" as a platform to "work" for the benefit of the "students". Overall, respondents favoured the ease in use of the adobe technology due to its simplistic approach compared to the other technology ("Seamless and not having multiple screens"; and general ability to have "paced learning"). There were a few concerns reported on the Adobe Connect technology, however, they were just minor technical issues like "Small fonts on the questions". Overall the heat mapping concept considerably favoured Adobe Connect and in fact none of the other technologies were even ranked in the 15% relevance for ability to form correlation or conceptual maps. So there was a clear disparity in perception in terms of favoured technology.

The relevance of "Adobe Connect" as a preferred technology was due to some students having used the Adobe Connect lectures at home as many of the subject sites used that technology for online meetings. While there were a few technologies where the respondents did feel that their perception were not favourable due to the "app:" not being reliable, or just the difficulty in trying to port with ease along the different technology platform (Blackboard). When the free text is read, it was clear that most of the students did favour the Adobe Connect technology in terms of engagement over the other technologies. Examples include:

> *" Well, my experience was the same maybe because we are use to having lectures in Adobe Connect so that's something we feel familiar with already but those other ones are fun."*- Wagga Participant 1

> *"I think particularly for DE I like Adobe Connect because it seamless, it's all there in one technology. Your not jumping from one screen to another*"- Wagga Participant 3

Subject trials

The interactive lectures in Foundation for Biochemistry were utilised by approximately 9% of students on a weekly basis and Echo360 recordings used by 20% of students. Apart from the first few weeks of the trial, the number of views of the edited video (loaded to YouTube) were less than the actual tests completed (Figure 2). When the results of the answers given to in-lecture questions

are compared there were few consistent differences between live lectures and responses entered later in Blackboard for interactive lectures (Figure 3). The pattern of responses were similar between most groups and in all circumstances the feedback given in the live lecture was appropriate for the answers and understanding of students viewing the lecture recordings (Figure 3).

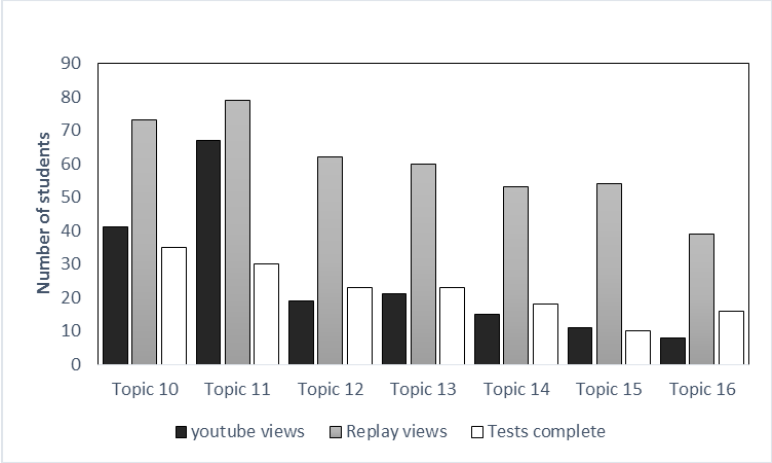

Figure 2. Total number of students accessing the online lecture resources for Foundation of Biochemistry in 2016.

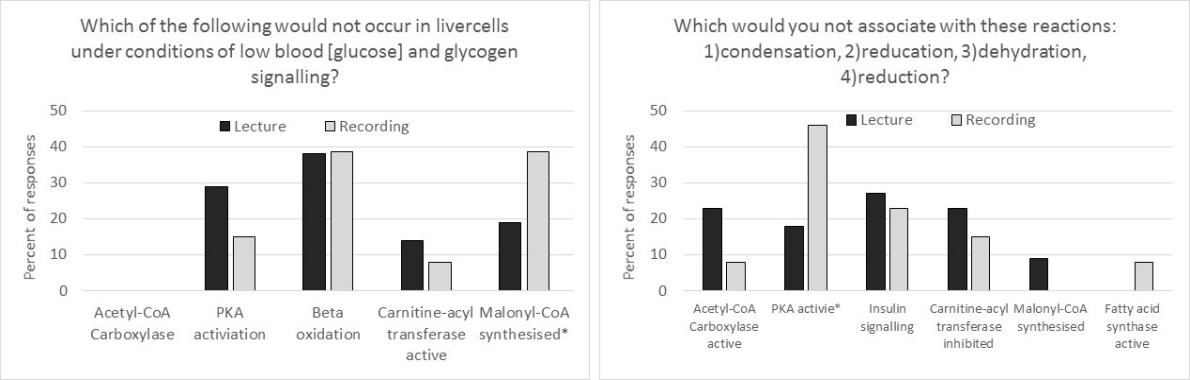

Figure 3. Example questions used in Foundations of Biochemistry, comparing responses received during the live lecture and responses based on the interactive recording (using Blackboard as the question tool).

In Physiological Sciences 1 the recordings of Adobe Connect sessions were typically utilised by only a small portion of the students (<10%). However, the sessions after quizzes were introduced were more widely viewed and accessed on multiple occasions (Figure 6).

A total of 43 surveys were returned across both subjects, with 29 responses returned for biochemistry and 14 responses for Physiological Sciences 1. Students across both subjects reported that they were happy with the use of in-lecture questions and wanted to see it in more of their subjects (Figure 4). Occurrences of technical issues were rarely reported and student were generally happy to use their own devices. All respondents said technologies were easy to use and that they would be happy to use them on their own devices in class environments (Figure 4). Some differences were observed in the quality of feedback with Adobe Connect (with Quiz Connect) scoring lower than the other categories (Figure 4), probably due to the timing aspect of this tool. Responses for interactive lectures appeared most variable because of differing opinions on technology (as can be seen below in the analysis of open responses some thought they were good and some thought better integration was needed).

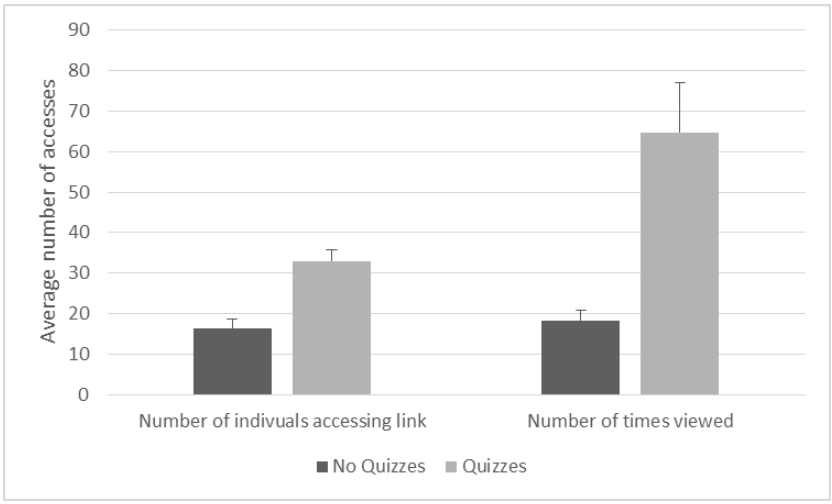

Figure 4. Mean (± SE) number of individuals that accessed the recordings and the average number of times they viewed the recording before and after quizzes were added for Physiological Science 1.

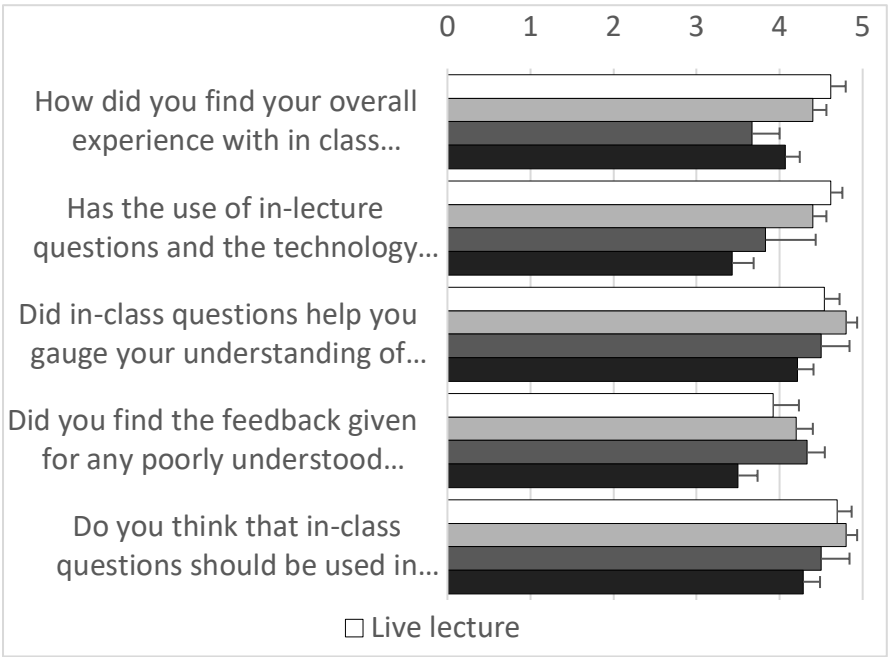

Figure 5. Comparison of mean (± SE) survey responses for the different types of lectures accessed by students in both Foundations of Biochemistry and Physiological sciences 1. Ranking of 0= strongly disagree/ poor to 5= strongly agree/ excellent.

Of the surveys completed, most respondents (97%) also provided responses to the open ended questions on what they found most and least helpful with the technology. Three specific themes emerged which included: (a) increased engagement (b) consolidation of learning and (c) technical or platform issues. Quotations used within each theme indicate verbatim remarks by the participants.

Table 1. Example responses for each theme from open ended questions of the four different types of lectures provided in Physiological Science 1 and Foundations of Biochemistry.

	Key themes	
Increased engagement	**Consolidate learning**	**Technical or platform issues**
Adobe Connect		
It was good to have real time quizzes on content specific to our subject as it's a great tool for learning	*Relevant questions, gained clarity on a number of confusing topics*	*It was way too fast!*
A very powerful learning tool, hope it is adopted across campus.	*Unexpected questions that truly test your knowledge as would actual exam without exam pressure, great for doing prior to the online mini tests*	*The short amount of time for questions. Some people read slower which this didn't quite take into account.*
It's fun (as long as the results don't count towards a final grade :-)!)	*It helps you understand things/concepts you aren't 100% comfortable with.*	*Some questions were a bit lengthy, by the time you read them, the timer was nearly done.*
Live lecture		
Forces you to ask yourself if you were paying attention to the content	*A great way to ensure you were understanding most concepts while they were being taught, also it encouraged me to stay on top of the work from previous lectures and continue writing notes for the current one*	*The connection was sometimes weak and/or program sometimes disconnected and it would take some time for either lecturer to establish it again in order to complete the clicker questions effectively*
It made it easier to concentrate in class as it was fun and engaging	*The clickers, able to see what we understood from what was taught*	
CSUreplay		
I was more engaged in the lectures anticipating the questions and hoping to get them right	*Good gauge of understanding and example questions for exams*	*Often too long a pause to collect answers and some technical issues holding up the lecture*
Really liked to guess the answers to the questions even though wasn't participating - made me pay more attention and retained more info.	*It made me realize whether or not I really grasped the concept.*	*I also found it annoying when only a few people in the lecture would answer the questions.*
Interactive lectures		
I felt I could participate in the questions rather than just watching	*The MCQ in-lectures helped me to understand better.*	*I'd like better integration otherwise I will stick to the normal lectures*
I liked being able to view lectures and respond on my own device in a relaxed manner	*I was also able to use the questions for revision*	*Unless the technology is much upgraded so the interactive lectures download instantly and you are able to use them without having to answer the quizzes in a separate window I don't think I would use them in future*

3.5 Engagement, dissemination and sustainability

The current project aimed to examine technologies that can increase engagement in online lectures through in-class questioning and to then offer resources and professional development so other courses or subjects at CSU could also be improved. Originally, the outcomes of the project were going to be distributed through internal conferences (CSUed), PD sessions and a range of resources/ documents. However, due to the poor attendance for PD sessions, the current abundance of course design workshops at CSU, the lack of a CSUed conference in 2016 and the need for a more sustainable and accessible format of providing PD and resources, an easily accessible website will be be developed. It is expected that this will increase the longevity of the influence of this project and ensure that the resources can easily evolve as technologies change and improve in the future. A key benefit of this project is the strong involvement of educational designers which not only ensure the pedagogical integrity of the resources created but also allows them to leverage their role to distribute and utilise the resources.

The core resources that will be housed in the website include:

1) Documentation
    a. Design framework for in-lecture questions (including pedagogical principles and subject design considerations)
    b. How to use Quiz Connect
    c. How to use i2 tests in lectures
    d. Effective feedback for in-lecture questions (including pedagogical principles and i2 tool to facilitate effective feedback)
2) Technology summary
    a. Tabular comparison of some of the more common technologies
    b. Links to various pages and other evaluations
3) Videos
    a. Think piece style videos to encourage increased lecture engagement
    b. How to videos (case study examples and how this was implemented)
4) Social media links
    a. Links to relevant blogs or groups (e.g., yammer and external sites which the project team or CSU academics are active in). This would be used to keep the site active and to ensure the discussion and developments continue.

Dissemination will occur further through the integration with the CSU online learning Model (OLM). In particular, the involvement of N. Miles as an OLM Specialist ED for eAssessment and close working relationship with other elements in the model will ensure any resources or documentation produced will serve a dual purpose (e.g., the current project and the OLM scale up). Many of these documents are currently being produced in collaboration with OLM ED specialists and will incorporate the changes resulting from feedback obtained in this study. This linkage will ensure the outcomes of this project can be replicated to all disciplines at the university and this will not only be a highlight for CSU, but with the expected publication of these results in 2016/2017 will also showcase the fact that CSU is at the forefront online education.

3.6 Wider implications

In-lecture questions were generally well received by all participants in this project. The results are in contrast to that reported elsewhere in which distress has been reported by online students due to the increased use of technologies (Hara, 2000) but in alignment with previous work at CSU (Miles and Soares da Costa, 2016). There is no literature available for the use of in-lecture questions by

online students but some information is available for its use synchronously across multiple campuses. For example, Clauson *et al.* (2011) reported that 85% of respondents thought clickers made it easier to participate in-lectures that were broadcast to their lecture room from a remote location. They also found that 80% of students felt they participated more in class as a result of clickers than they usually would. However, the most positive perception came from students who were at the location where the lecture was being delivered.

In our study, all students clearly displayed a desire for more interactivity and engagement in their lectures but also provided a clear warning that this must be a seamless integration otherwise they can become frustrated and disengaged. These results clearly reflect previous studies such as that by Gikas and Grant (2013) that examine the use of mobile devices in higher education in which they found that students liked and recognised advantages in the increased use of these technologies but there were also a number of frustrations with their use. Similarly, these frustrations also included applications that did not work as well as had been anticipated.

Overall, we found that students did want to be more engaged but they would prefer to remain with one technology across their subjects and this should have seamless transition between any different platforms or tools. This is probably an institutional responsibility to ensure that the university learning management system (LMS) can fully support its learning and teaching requirements (Bates *et al.*, 2011). In addition, similar to studies on clickers in live lectures, feedback and the overall pedagogical approach was highlighted as an important factor contributing to the success of a technology (Trees and Jackson, 2007; Miles and Soares da Costa, 2016). An important note in regards to the pedagogical approach, was that students often commented on scaffolding the activity, so they had some experience in the technology before entering into a time restricted situation like a lecture. Given these conclusions it is not surprising that Adobe Connect was preferred as they were already familiar with the platform and the addition of a small add on improved the engagement. It must be noted that another advantage of Adobe Connect is that there are a number of quiz like add on's, many of which also work in the recording and not just the live meeting or lecture. A key example of this is the more advanced EduGame Cloud (https://www.edugamecloud.com/) which has more formal assessment capabilities than Quiz Connect, albeit this technology does come at a cost to the individual or institution.

3.7 Conclusion and reflections

In-lecture questions and the technology used to deliver this was well received by participants in a focus group study and students in subjects where these technologies were further trialled. Overall, both internal and online students perceived significant benefits for their educational experience. However, the more streamlined and integrated the technology the better it was received by the students. Students also picked up on the pedagogical importance of appropriate feedback and scaffolding in ensuring optimal engagement.

Although limited in size, this project has demonstrated that a core method used to increase engagement in face to face lectures can be utilised and adapted to improve the quality and engagement of lecture recordings provided online. However, the amount of time and resources required to effectively scaffold this into a subject, so that it offers a quality experience for students needs to be considered.

Appendices

Appendix A. Financial report

The table below shows the budget for the current project. The small difference in the budget is a result of the focus group study not having the maximum number of participants (A maximum of 30 were budgeted for but a minimum 10 required) with 12 participants used in the project.

Budget item number	Budget item description	Basis of calculation	Budget ($)	Spent ($)
1	Relief CI N. Miles	160 hours @ Level 7 Step 3 $56.19 + 16.5% on costs	10473.82	10473.82
2	Teaching relief G john	60 hours @ AX165 $57.55 + + 16.5% on costs	4022.75	4022.75
3	Relief K . Hicks	20 hours @ Level 7 Step 3 $56.19 + 16.5% on costs	1309.23	1309.23
4	Social Research (design expertise)	20 hours@AX180 $61.57 + + 16.5% on costs	1434.58	1434.58
5	Student participation incentive	iPad Wi-Fi + Cellular 16GB x 6 @ $346 each (or vouchers)	2076	600
6	Catering (lunch) for focus group	Catering for ~25 people at the focus group	338.75	0
		Total	**19655.13**	**17840.38**

Appendix B. Technologies examined in the current study

Adobe Connect (with Quiz Connect): http://www.adobe.com/products/adobeconnect/apps/quiz-connect.html

Echo360- Active learning platform: http://echo360.com/

Blackboard (i2) mobile tests: http://help.blackboardmobile.com/customer/portal/topics/556418-mobile-tests/articles

Turning technologies: https://www.turningtechnologies.com/

Appendix C. Focus group questions and survey instruments

Part A: Closed questions for focus group online survey (survey monkey):

General

1. Of the 4 technologies trialled please rank them from 1-4 in terms of ease of use (with 1 the best and 4 the worst)
2. The sound and picture quality was clear (agree to a large extent – disagree to a large extent)
3. I found at least one of the technologies to be an interesting way to increase engagement in-lectures (agree to a large extent – disagree to a large extent)
4. I was happy to use my own device in this study (agree to a large extent – disagree to a large extent)
5. I would be happy to use my own device or devices for this type of activity in my future learning (agree to a large extent – disagree to a large extent)
6. Did you use your own internet (mobile data) or wifi for this trial?
7. Did you have difficulty connecting to the internet
   (Yes-own, No-own, Yes- wifi, No-wifi, Yes- I could not connect to either network for some or all of the study)

CSU Replay

8. Navigating and using the CSU Replay platform was easy? (agree to a large extent – disagree to a large extent)
9. Responding to questions in CSU replay (selecting and submitting answers) was easy? (agree to a large extent – disagree to a large extent)
10. I did not have any technical issues with CSU replay questioning? (agree to a large extent – disagree to a large extent)

Turning technologies (TT)

11. Navigating and using the TT platform was easy? (agree to a large extent – disagree to a large extent)
12. Responding to questions in TT (selecting and submitting answers) was easy? (agree to a large extent – disagree to a large extent)
13. I did not have any technical issues with TT? (agree to a large extent – disagree to a large extent)

Blackboard (i2)

14. Navigating and using the i2 platform was easy? (agree to a large extent – disagree to a large extent)
15. Responding to questions in i2 (selecting and submitting answers) was easy? (agree to a large extent – disagree to a large extent)
16. I did not have any technical issues with i2 questioning? (agree to a large extent – disagree to a large extent)

Adobe Connect

17. Navigating and using the Adobe Connect platform was easy? (agree to a large extent – disagree to a large extent)
18. Responding to questions in Adobe Connect (selecting and submitting answers) was easy? (agree to a large extent – disagree to a large extent)
19. I did not have any technical issues with Adobe Connect questioning? (agree to a large extent – disagree to a large extent)

Questions for focus group discussion:

1. Do you think integration of one of these technologies into a class/ online environment would be useful for you classes?
2. Did technically difficulties cause distraction?

3. What was your favourite technology and what was your least favourite? Why? What could be done to improve these technologies
4. Would you be comfortable participating in these type of activities from home?
5. Was it difficult to learn using these technologies? Was more guidance required?
6. Do you have any other general comments about the use of in-lecture questions and the technology used?

Part B: Subject trial

1. How did you find your overall experience with in-lecture questions and the technology used to deliver this? (extremely positive- extremely negative).
2. Has the use of in-lecture questions and the technology influenced your level of engagement in class? (yes to large extent- no)
3. Did in-lecture questions help you gauge your understanding of course content? (yes to large extent- no)
4. Did you find the feedback given for any poorly understood concepts useful? (yes to large extent- no)
5. Do you think that in-lecture questions should be used in more subjects at CSU? (yes to large extent- no)
6. Did you experience technical or connectivity issues with the technology used? (no issues- continual issues)
7. Were you required to use your own mobile device? (no, these were provided- yes, for all lectures)
8. Would you be happy to use (or continue using) your own device for in-lecture questioning? (yes to large extent- no)
9. What did you find most useful about the use of in-lecture questions and the technology used? (open-ended)
10. What did you find least useful about the use of in-lecture questions and the technology used? (open-ended)
11. Do you have any other general comments about the use of in-lecture questions and the technology used? (open-ended)

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