Evaluation of student engagement with a lecture capture system

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Abstract

There are potential operational and strategic benefits to implementing lecture-capture systems but the issues are much deeper than simply the question of which technology system to implement. This paper explores the lecturer and student perspectives by analysing survey data from a small scale time-terminated implementation. Results show that an automated lecture-capture system could be readily implemented in existing teaching venues, with minimal adjustment to existing equipment and fittings. Students reported that the system enhanced their engagement. The trial was too small to reliably indicate how academic staff respond to such a system. However implications from the way students elected to use recorded lectures suggests that widespread adoption of the technology could have major effects on the lecture of the future, and potential implications for lecturers. Lecturers may need to prepare lectures specifically for this medium.

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1 Introduction

The most prominent mechanism of learning in universities is still the lecture. The chalk may have been replaced with felt pens and digital projectors, but the core idea remains of an expert standing in front of students and transferring knowledge via lecture. The debate now is whether or not those lectures should be recorded for student use, and how this affects student learning.

The *technology* for capturing lectures is established, and depending on the proprietary system used, can capture not only the video of the speaker but also the image displayed by the projector. However the more important issue is how this affects the *learning.*

Lecture capture has alluring potential benefits for learning. It permits students who missed the lecture to revise the content and see what happened. By extension, it therefore also provides a richer experience for distance students, who otherwise miss out on the classroom interactions. Furthermore, all students have the benefit of being able to replay the lecture and use this as part of their study and revision. Thus universities as *institutions* see considerable value in lecture capture, in both learning and strategic directions. However, universities as individual *lecturers* are less

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accepting of the practice, seeing it as inhibiting their freedom in class, requiring greater preparation, and making their small mistakes unnecessarily memorable. Also, there is a varying level of fear that lecturers could become obsolete were the institution to reuse the recordings for future classes.

Thus the issues with lecture capture are much deeper than simply the question of which technology system to implement. This paper explores the *lecturer* and *student* perspectives by analysing survey data from a small scale implementation.

2 Background: Multimedia capture, learning and teaching

How the technology works

In a manual video capture the lecturer and audio are recorded manually by a camera operator on a digital video camera. The projector output is videoed, less than an ideal situation, and mixed at the time of recording with images of the lecturer, full audio is recorded. Post production is limited to minor edits and the product is a video that is basically as the lecture happened. There is no indexing of points throughout the presentation. The video is then uploaded to a website to which students have access. This takes at least the same time that the video runs for, causing a delay in making the video available to students.

More sophisticated technology solves both those problems. The lecturer can choose to have their image captured along with the output from the projector system. This is largely automated and once the recording begins the lecturer proceeds with the presentation. An attendant is not essential. Full audio and visuals are captured. The lecturer closes the system at the end of the presentation, and can pause part way through as desired. Students subsequently access the video from a nominated website, and depending on the software may be able to navigate to marked index points. A related type of production uses software housed on the lecturer's computer, which captures the screen activity of the notebook computer and allows the same automation of upload that the lecture theatre version does.

Known issues

Much has been written in the literature related to the capture of lectures and other learning opportunities. For the purposes of this discussion, three studies have been selected as representing the latest, relevant information on the matter. The first study represents a synthesis of current literature on the use of digital recording technologies in the service of enhancing the student learning experience. This study was conducted by Milne and Brown (2011) as part of a business case to be presented to management at Massey University in New Zealand. The second study examines the impact of "web-based technologies on current and future practices in learning and teaching", from an Australian perspective (Gosper et al., 2008). The third study reports on a JISC-supported implementation of *Echo360* at the University of Coventry (Morris, 2011).

The Milne & Brown (2011) report presents a synthesis of current literature (since 2008) related to the digital recording of learning opportunities, with a specific focus on the extent to which the use of such material might enhance

the student learning experience. The following broad conclusions are drawn from their synthesis:

- Digital recording of rich media (mainly lectures) is commonplace in many universities.
- For the purpose of this report the definition of rich media learning is taken to mean enterprise wide systems of recording (audio and video) digital content (including lecture capture) for teaching and learning purposes.
- Although the recording of lectures can reinforce traditional forms of teaching, there is strong evidence that students want rich media, and use it when it is available and well integrated within the teaching and learning experience.
- That said, students need help to effectively incorporate rich media into their learning and help to relate it to other resources and activities. It can even be counter-productive to effective and efficient learning.
- The most frequent use of rich media is currently to provide a digital recording of what happens in a lecture. Research suggests that recording traditional lectures adds relatively little pedagogical value to the student learning experience. Indeed, there is some evidence that this type of media rich learning can actually increase student workload and lead to more passive forms of learning.
- Innovative case studies illustrate how staff can use rich media to provide active learning for students such as providing feedback on student presentations, allowing students to interact with the rich media so they can share summaries and having further opportunities to discuss and ask questions.
- Put simply, the real value of rich media learning depends on how it is used by staff and students. The principles of effective teaching apply to the use of rich media learning and the digital recording of content should be fully integrated with other learning experiences, particularly the learning management system.
- Ideally there should be a follow up activity, which relates to the digitally recorded content, so that students are required to engage with the material in a manner that is constructively aligned with the learning intentions and course assessment. In other words, rich media must be fully embedded in course design rather than 'added on' to an existing paper as an optional extra.
- Most effective use of media rich learning is when recorded content is packaged as small learning objects or nuggets which have been carefully edited or selected to scaffold the student learning experience. Such objects also have the advantage of potential reuse in related courses.
- The pedagogical benefits of rich media learning depend on the way it is used by staff and requires appropriate professional development. In addition, some teachers are resistant to digital recording due to ethical and professional concerns. Therefore, it is essential to support digital recording initiatives with appropriate policies and procedures.
- An increasing abundance of rich media is now available for learning and teaching as open educational resources (OER). Some of this material is high quality content and more universities are actively promoting the use and repurposing of OERs rather than investing in producing their own rich media (Milne & Brown, 2011, p.2).

The report produced by Gosper et al. (2008), rather than focusing specifically on the student experience, highlights ways in which web-based lecture technology (WBLT) might influence learning and teaching practices more generally – both currently and in the future. Specifically, the study sought to shed light on: ways in which technology might be integrated successfully into the curriculum; ways in which technology can support learning and teaching more effectively, taking into account the fact that such practices occur in different contexts; and educational implications of its use for curricular design, academics, students, professional development and academic policies and practices (Gosper et al., 2008, p. vii). The following broad conclusions were reached:

- Students appreciate the flexibility afforded by WBLTs in access and support for learning. Academic staff recognize the value of WBLT for off-campus students but express concern over the fact that on-campus students chose not to attend classes as a result of using the technology.
- WBLTs have contributed to the blurring of the difference between off-campus and on-campus students
- The introduction of WBLT will change lecture attendance patterns and may raise questions about the role of lecturers
- Using WBLT demands changes in the way students learn and teachers teach – 68% of students using WBLT believe they can learn just as well using WBLT as they can face-to-face
- Introducing WBLT is more than a teaching issue – it will affect the design of the whole curriculum. Despite this, the study showed that 75% of staff reported they had not changed the structure of their unit
- Introducing WBLT has professional and organisational development implications. Empowering academics by encouraging a culture of innovation and experimentation with new technologies and enabling them to make informed decisions about the appropriateness of technologies in their own context may be more effective and sustainable in the longer term. (Gosper et al., 2008, p. vii-x)

Both reports highlight the importance of integrating capture technology effectively into the curriculum in ways that demand curricular redesign; a reassessment of the lecturer's role; effective support practices for both staff and students; and an understanding of the fact that merely capturing all lectures in their traditional, raw form does not constitute the most effective learning and teaching strategy to adopt in this regard.

The University of Coventry project involved the implementation of automated lecture-capture (ELTAC) (Morris, 2010). Their conclusions were:

- We underestimated the extent of technical issues. These were mainly a product of our policy of integrating our e-learning systems with each other to provide an easily understood and usable platform for both students and staff.
- ELTAC also laid stress on the automated capture of lectures. Teaching staff were unhappy at giving up complete control to an automated system. They wanted to be able to start recordings when they were ready and have visual feedback that recording was in progress. … The term "lecture" also covers a wide range of different teaching and learning events. …Not all lectures proved to

be easy to capture using standard room layouts and capture infrastructure.

- ELTAC also challenged the view that lecture capture was neutral and automatic in the sense that the act of capture did not require any adjustments to the lecture itself. It is clear that captured lectures are not used as simple substitutes for the original presentation. The context and ways in which students use captured lectures is different and lecturers need to be aware of this when developing teaching material. Staff development in simple instructional design considerations became an important part of the project and the associated materials are a significant project output.
- The project also considered lecture capture in the context of institutional business models. Long term sustainability for institutional lecture capture depends on there being a clear link between the pedagogic affordances of the service and institutional business plans. This could be through differentiating the offering, raising retention, reducing the need for lecture repetition, helping students who find learning from lectures difficult, providing a shop window or extending international partnerships and provision. The potential for cost savings is unlikely to be the sole driver for introducing lecture capture. (Morris, 2010, p.4)

Besides the technical issues associated with institutional e-learning systems, which seem to be endemic to this particular context, even this particular trial of specific capture software raises important concerns regarding the ways in which such technology might be integrated institutionally into learning and teaching practices.

3 Case situation

As shown by those three studies, there is a need to better understand how lecturers and students engage with lecture-capture systems. In the specific case under examination, the University of Canterbury (New Zealand) was planning a small scale implementation of lecture-capture using the *Echo360* product.

The university had previously used manual lecture-capture,[4] and was interested in trialling an automated system. This interest was heightened by the recent earthquakes that had affected the city and had severely disrupted the teaching programme at the university. The university was therefore particularly interested in the possibilities of lecture-capture systems being used to add resilience against future disruptions.

The objectives of the trial implementation were:

- Ascertain the extent to which the system could be successfully implemented in existing teaching venues, with minimal adjustment to existing equipment and fittings.
- Ascertain academic staff and student experience of the system, with specific reference to ease of use and ways in which such a system might influence learning and teaching practice.

[4] The experience with the manual system had shown that it was labour-intensive and difficult to scale up to a wider implementation.

- Determine and compare costs of the manual and automated capture systems.

3 Method

The *EchoSystem*, from manufacturer *Echo360*, was installed in three lecture theatres. Installation involved software and capture appliances, and training for support-staff. The system allows for automated lecture capture, processing and delivery that allow students to access recordings for review in as little as one hour after the lecture has been delivered. Captured content in formal teaching spaces could encompass audio, video (from a fixed camera focused on the lectern) and a video feed of content projected by one data projector. Captured material and additional content was delivered to students via links within the relevant *Moodle* courses. The project ran for the second teaching semester in 2011.

Academic lecturer participants were invited on the basis of who would be teaching into the three capture-enabled venues. This almost certainly meant that the early-adopters were represented. Additional participants agreed to use and trial other features of *EchoSystem*, such as the personal capture software and the external media ingest tool. One possible use for the personal capture software was considered to be the capture of lecture content that was delivered from other teaching spaces. The whole university was in a situation of considerable disruption over this time, owing to the closure of earthquake-damaged buildings and the resultant changes to timetables.

Data were gathered during the project on usage generally. In addition, staff and students were surveyed about their experiences (ethics approval obtained from the University of Canterbury). During the course of the lecture capture pilot project, 187 lectures had been captured across 16 courses. In total, 2136 students had been enrolled in these courses. 178 students responded to the online survey made available to them at the conclusion of the pilot.

4 Results

4.1 Student usage and experience

To what extent did you use the lecture capture recordings?

The first question elicited responses related to the extent to which students had reviewed captured lectures. In this regard, 27.52 % (49) of students indicated that they had used the recordings often and 29.77 % (53) of students indicated that they had used the recordings very often, with 38.76 % (69) indicating moderate usage. See Figure 1.

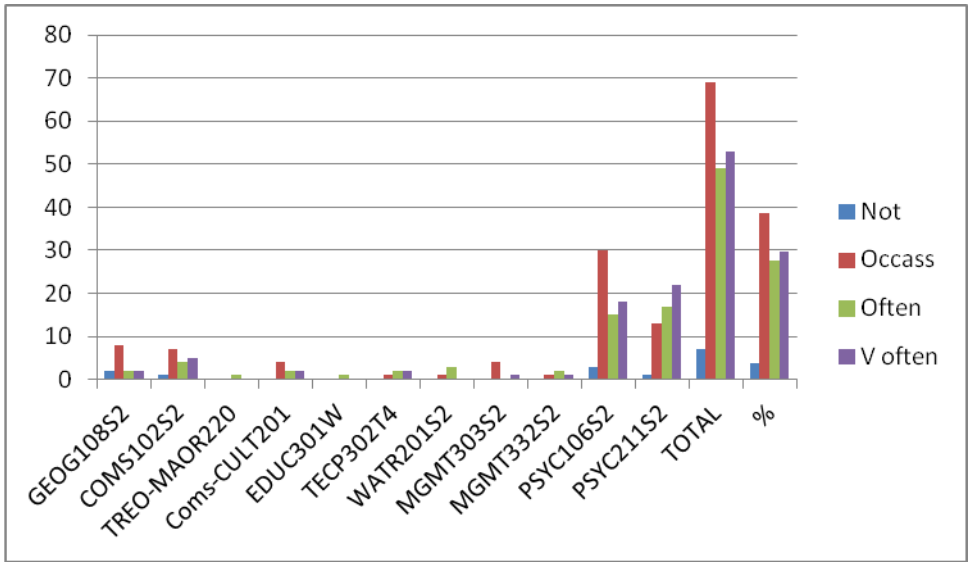

Figure 1: To what extent did you use the lecture capture recordings?

What did you use the lecture capture recordings for?

The reasons supplied by students for their use of the system were as follows: 43.55 % (98) of students used lecture recordings to make up missed classes; 25.33% (57) used the recordings in order to assist with their revision of work during term time, while 26.22% used the recordings to assist with revision of work in preparation for assessment opportunities. See Figure 2.

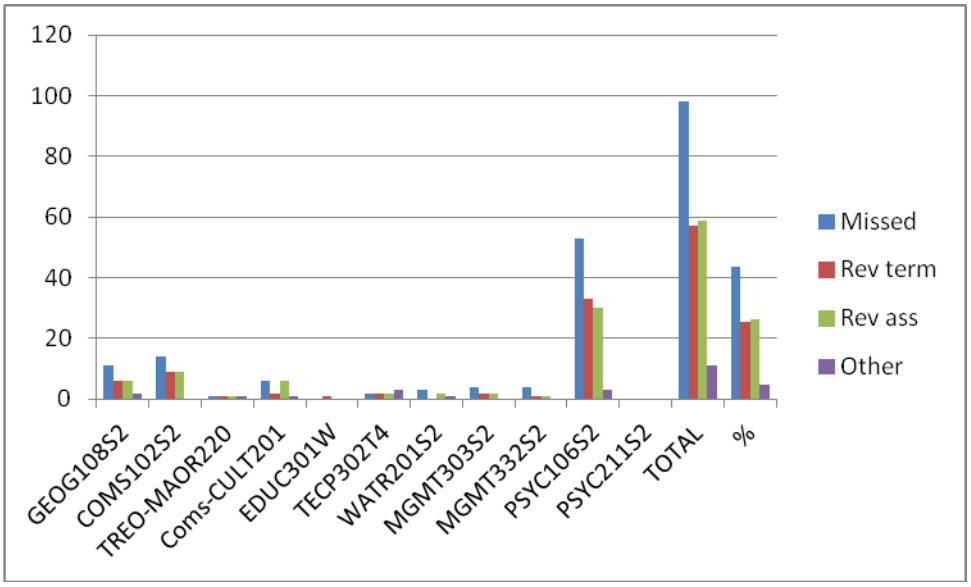

Figure 2: What did you use the lecture capture recordings for?

What was your reason for viewing the lecture capture recordings?

In addition, students were asked to indicate why they had been drawn to reviewing a captured lecture for the first time. 39.02% (112) of students responded that they had viewed lecture capture recordings to assist with revision of their work, while 39.02 % (112) of students used lecture capture

recordings because they were unable to attend lectures. 17.07 % (49) of students indicated that they used the lecture capture recordings because they chose not to attend lectures. See Figure 3.

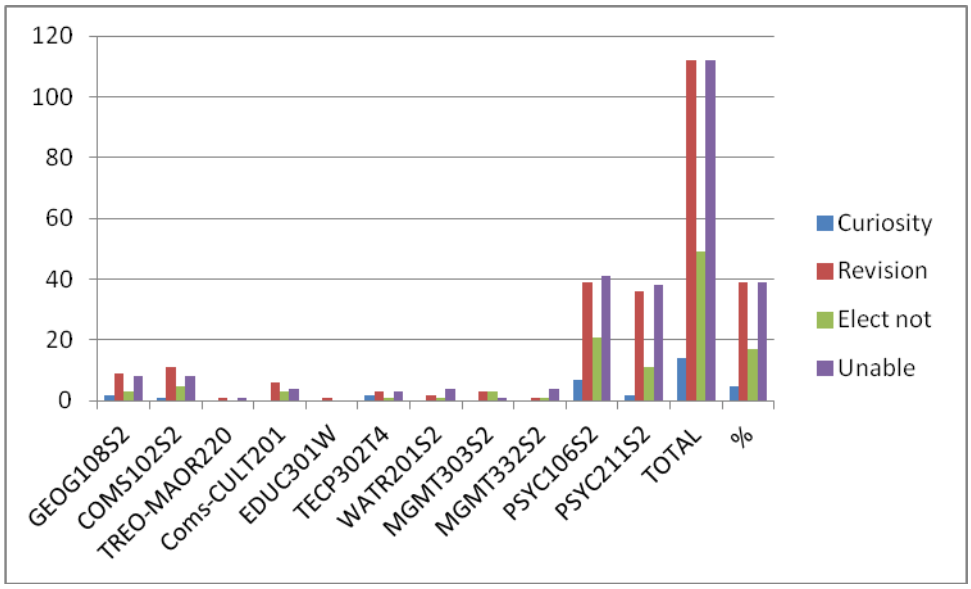

Figure 3: What was your reason for viewing the lecture capture recordings?

In addition to the responses discussed above, students were asked to provide richer comments on selected aspects of the pilot project. In the first instance, they were invited to expand on what the reasons had been for their use of the lecture capture recordings. Their responses focused almost exclusively on the following reasons: catching up on missed lectures; reviewing lecture material during term time; reviewing lecture material with a view to preparing for assessment opportunities; timetable clashes; and the fact that some of the students had been distance students.

Students who indicated that they had used the lecture recordings to catch up on missed lectures indicated that the main reasons for missing lectures were illness, emotional distress, and work commitments. Only three students specifically named timetable clashes as a reason for having missed lectures. One student also made mention of the fact that recorded lectures were made use of because travelling long distances to campus for the sake of a single lecture was uneconomical.

To what extent did the lecture capture programme enhance your engagement with the course?

Students were asked to what extent the lecture capture pilot had enhanced their engagement with the course. Generally the students reported that the lecture capture did enhance their engagement to a moderate extent or better, see Figure 4. A minority of 6% found no benefit at all.

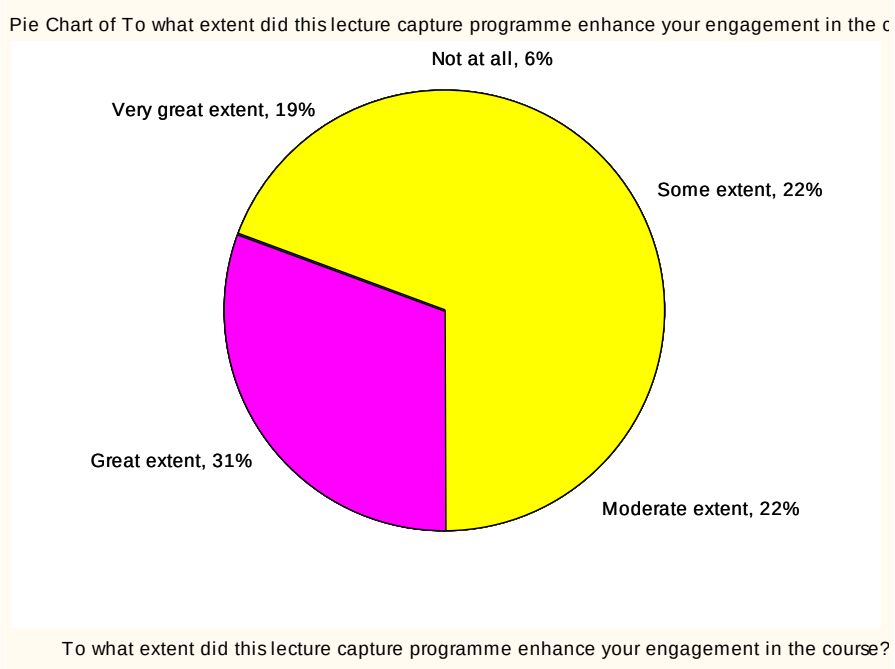

Figure 4: Student self-report of engagement, across all courses.

However there is variability in student engagement scores across courses, as Figure 5 shows.

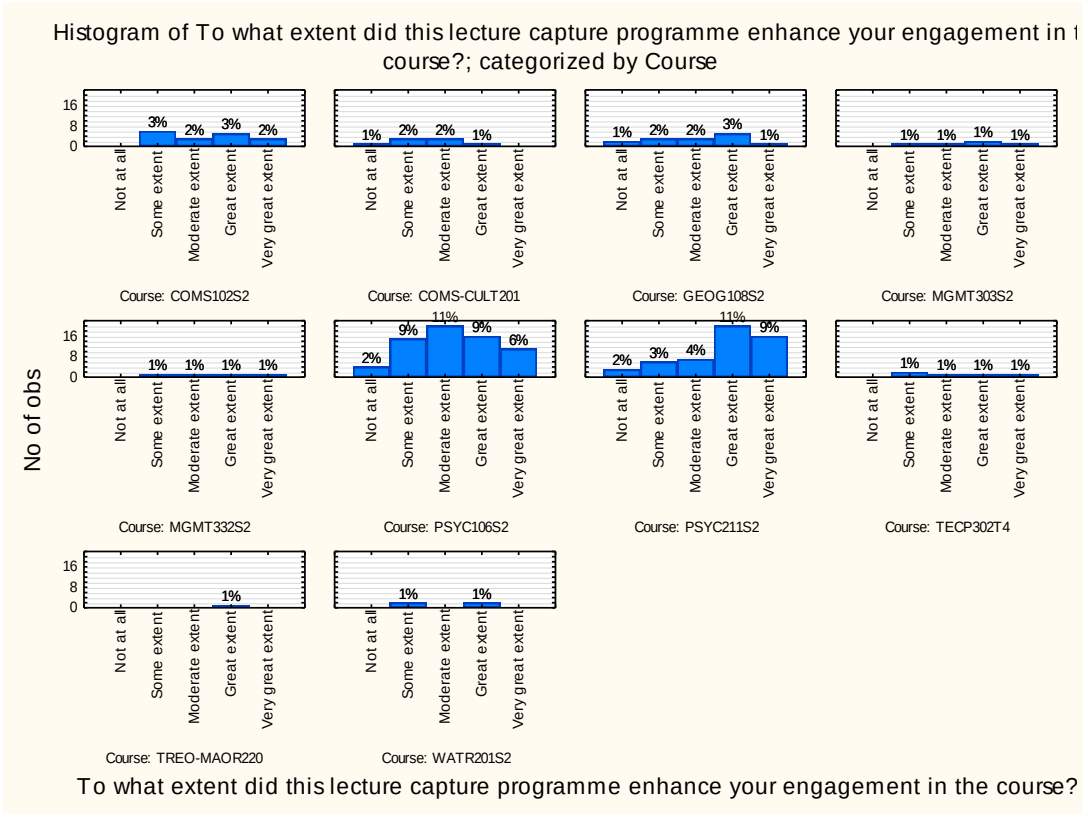

Figure 5: Student self-report of engagement by course.

Further analysis is provided in the ANOVA results in Figure 6. Some courses had small class sizes so the confidence intervals are wide and not much can be drawn from that. However the two psychology courses, PSYC106 and PSYC211, had large-enough samples sizes to detect that their differences (PSYC211 had greater engagement) were statistically significant.

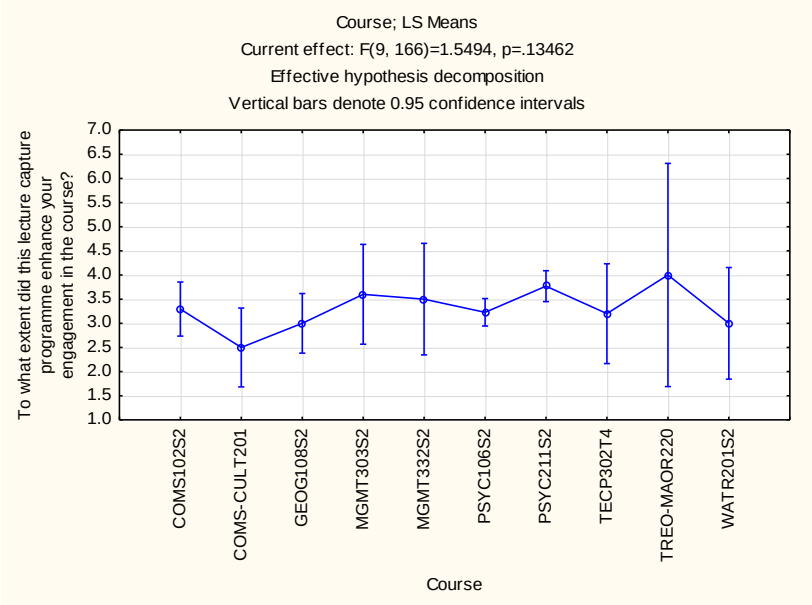

Figure 6: ANOVA breakdown of course engagement.

As might be expected, usage is correlated with engagement. Those students who used it less, reported less usefulness, see Figure 7. Those students who

used it very often also reported high levels of engagement. However the causality is unknown: it is difficult to know whether high usage results in high engagement, or whether students with naturally high engagement simply tended to use it more, or some other causality.

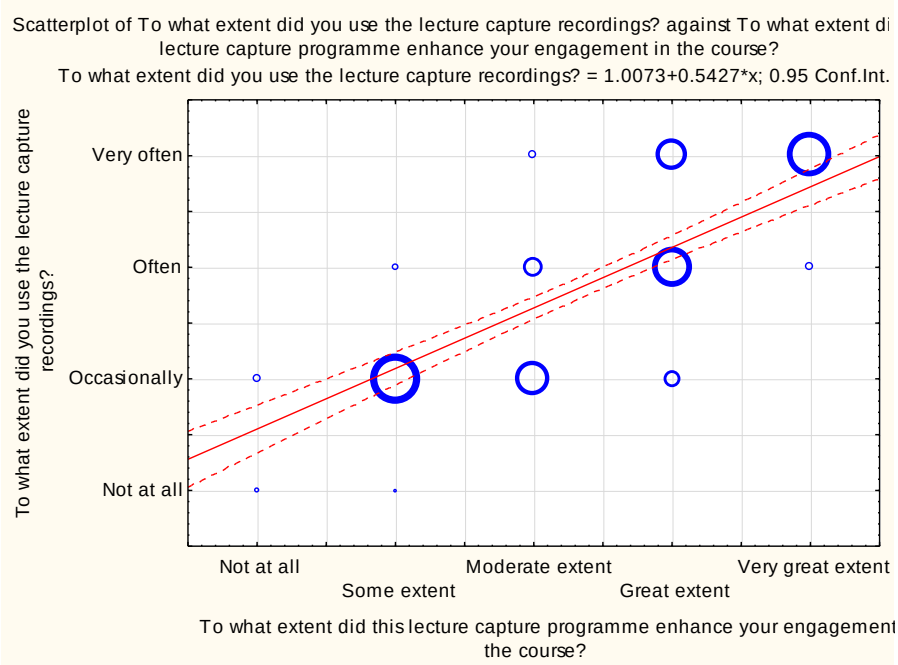

Figure 7: Student usage of lecture-capture material is correlated with engagement

Benefits as perceived by students

Question 5 of the student survey invited the students to comment on the benefits and positive features of the lecture capture programme. The most commonly identified benefit of the system was the ability to enable the making up of missed lectures. In addition, students indicated that reviewing captured lectures played an important part in improving their understanding of the subject matter and also assisted them in compiling more accurate and effective lecture notes. A number of students also noted that a review of the captured lectures also ensured that their preparations for assessment opportunities had been better. Finally, a number of students commented on the fact that the *Echo360* captures represented an environment designed to be more conducive to encouraging effective learning, particularly in comparison to the manual captures. The most important point of difference seems to have been the fact that *Echo360* delivers simultaneous feed of both the talking head as well as the *PowerPoint*/document camera feed, whereas the manual capture is only able to alternate between the two.

Areas for improvement as perceived by students

Question 6 of the student survey elicited responses to an evaluation of ways in which the lecture capture programme might be improved. The most commonly reported technical problem seems to have been the fact that audio levels were generally too low. It is unlikely that this is a matter relating to either user audio settings or lecturer recording practices since the problem was reported by numerous students across different courses.

Many students indicated that the programme could be improved by capturing the lectures associated with all of their courses.

Some student comments related to lecturer presentation practices that could improve. These practices are clearly related to lecturer inexperience in preparing lectures specifically for capture (e.g., ensuring to repeat questions asked by students in class since student input is not captured). In addition, some students made mention of the fact that recorded lectures were not made available as quickly as they had expected.

4.2 Experiences of Academic staff

At the conclusion of the *Echo360* Pilot project, academic staff members involved were invited to complete an online survey aimed at capturing data relating to their use and experience of the *EchoSystem*. The 16 courses involved in the project were facilitated by 12 academic staff members and 5 of these academic staff members responded to the survey. Usage information retrieved from the *EchoSystem* indicates that lectures were captured in one of three ways. Of the 16 courses involved in the project, 9 courses utilized material captured by lecturers via *Echo360* personal capture software located on their personal devices; 4 of the courses utilized material which had been captured via in-class *Echo360* appliances; and 3 of the courses utilized materials that had been uploaded to the *EchoSystem* from external sources.

Responses indicated that 4 staff members were satisfied with level of technical support they received. The majority of respondents (3) recorded only audio and data projector feeds and 4 of the 5 respondents either used the recorded lectures as finished products or made minor changes to the recorded lectures. In addition, respondents indicated that they had only reviewed some of these captured lectures before making them available to students while 1 respondent indicated that no such review had taken place for any of the captured lectures.

In terms of student use of the system, 3 lecturers believed that use of the system had only influenced student engagement to some extent or moderately. In addition, 3 respondents indicated that student class attendance during the course of the Project was similar to student class attendance in previous offerings of same course. Finally, 2 respondents indicated that that they would reuse either some or all of the lectures captured during the trial.

Respondents were invited to provide further comment on their experiences and lessons learned from the Project. The responses, while providing one or two useful comments on the usability of the product, were too cryptic to enable meaningful analysis or comment.

None of the respondents believed that involvement in the project had encouraged them to reconsider the ways in which they taught. Nor did they alter their resources to leverage the lecture capture environment. This may be a consequence of the short duration of the trial, and the knowledge that the technology platform might not be available to them in the future, thereby diminishing the value of too much personal investment in the system.

Consequently the trial probably did not elicit full engagement from staff, and perhaps not the full benefits of the system. It is possible that further gains might be made once the motivation was there for staff to specifically design their delivery for a lecture capture environment. Lecturing staff would reasonably need support and the absence of demotivating factors to achieve this. Also, the interesting question arises, with its implications for possible future research, as to what features of lecture capture are particularly effective for learning, and how to transfer this knowledge to lecturing staff?

4.3 Experiences of support staff

The university's electronic learning media team implemented the project and provided first-line support to academic staff. Their experience was as follows.

From an administrative perspective, the *Echo360* Project was easy to manage. During the Project, scheduling of recordings and training participants was done on an easily managed ad-hoc basis. Once scheduled, all recordings started and stopped as expected. The only work teaching staff had to do was ensure that they had a microphone turned on. This act also signalled the lecturer's permission to have the lecture captured. Most recordings were available to students within half an hour of the lecture finishing. The links to recordings were automatically emailed to lecturers which they then had to add to their Moodle courses for student access. A larger scale installation would use a Moodle integration that would automatically add new recording links, removing the need for lecturers to manually add the links.

There were no capture device failures or failed captures. There were two issues with the equipment in one of the capture venues: a camera was moved away from pointing at the podium and the audio levels were set too low in the mixer. The training in and use of the personal capture software (PCap) and external media ingest (EMI) features were also managed on an ad hoc basis when staff began to use the applications. As with the in-venue captures, the PCap and EMI files were made available via manual links to the relevant Moodle courses. For future implementations the team would consider putting more work into the use of PCap and EMI for the production of reusable learning objects (RLOs) as a way of using this technology to improve the student learning experience.

The support staff received only a small number of requests for assistance, from which it is inferred that staff and students involved in the project had a successful experience.

It is extremely difficult to compare costs associated with the current manual capture of lectures and the *EchoSystem* capture of multimedia files. Partly, this is a result of the fact that manual capture costs are predicated on the number of hours of lectures captured, whereas costs associated with the *EchoSystem* capture of multimedia content is predicated on the number of teaching venues fitted and the perceived need for video capture of lecturer talking heads. Partly, the comparison is also made extremely difficult by the fact that the two systems of capture provide vastly different products from a learning and teaching perspective.

5 Discussion

This project, though small in size of implementation, makes the important contribution of including all three perspectives: student, lecturer, and support staff. From this it emerged that the limitations are not related to hardware, software, or support. Rather it is the *way that students and lecturers use* the system that seems to matter the most.

Students generally used the recordings at least moderately. Of itself that suggests a high willingness to use the material, but it must be remembered that the novelty factor might not have worn off. Students used the material to catch up on missed classes and for revision.

There is a strong possibility that lecture capture capability may change the teaching setting. Specifically, we found that about 17% of students used the recordings *because* they had chosen not to attend lectures. What does this imply for the lecture of the future where capture could be even easier and more prevalent? If most of the students are not in physical attendance, then what does that mean for audience participation? Does the lecture audience become like a television-studio audience? We do not have answers to this, but can anticipate that lecturers may need to change their delivery to adapt to smaller audiences or to create a greater reason for student attendance perhaps through more interactive engagement in the lecture room.

Complementary to this is a question as to why students feel it could be sufficient merely to watch the lecture in video. Does this mean that it is only content information that they need? They apparently do not appreciate proximity of other students or the para-linguistics of the communication from the lecturer. Also, by deliberately skipping lectures, they apparently also had no intent of asking questions during class. Is this the changing nature of a more technology-enabled generation? Is this even a wise approach to learning?

Another effect that is interesting is student engagement. Students generally reported that the capture system did increase engagement. Again, this might be only a novelty factor. It was interesting that the increase in engagement varied between courses. We were unable to identify what was driving this variability. Some of the difference could be from the different topic areas (geology, management, etc). Even then significant differences were found within one area (psychology), which suggest that there are other variables. It may depend on the style of the lecturer, and if so this has implications for how academics might in future be trained to make best use of the technology. Student usage was correlated with engagement, but the direction of causality is unknown. Nonetheless this suggests that lectures that are captured need to be worthwhile for students to replay. This has potential implications for the content of such lectures and the design of their presentation. It is entirely possible that lectures that are intended for capture need to be designed differently to those that are intended for conventional delivery (i.e., that there might need to be a future differentiation of the lecture into subtypes).

It is curious that the lecturers assessed a lesser improvement in student engagement due to the captures, than did the students themselves. This suggests that there are different perspective of engagement. It could be worth further exploring this in any future work.

The number of academic staff participating in this trial was low, and it is difficult to conclude definitively from their responses. In addition, they self-selected into the trial, so presumably were positively disposed in the first place. What the implications are for the wider community of academics therefore cannot be determined from this study. However we do note that a policy decision was made at the start of the trial that the institution would, for this trial at least, not reuse captured material for subsequent years. This was done deliberately, to remove that debate from the trial. However, how universities make that policy decision in the future could profoundly shape the adoption of lecture-capture by staff.

6 Conclusions

The trial implementation of an automated lecture-capture system showed that the system could be readily implemented in existing teaching venues, with minimal adjustment to existing equipment and fittings. The trial was too small to reliably predict how academic staff will respond to such a system. More data were available on the student experience, who reported that the system enhanced their engagement.

Contribution statement

XX and YY designed the academic part of the study, ZZ and AA managed the operational implementation of the hardware, software and support. XX obtained ethics approval and did the statistical analysis. AA wrote the internal report. XX and YY wrote the paper.

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