Using Video Capture Technology to Enhance Student Performance

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ABSTRACT

A variety of technological advances have made it easier to deliver course content to students both in person and in archived formats. Lecture capture technology (LCT) platforms enable instructors to capture and post class materials with very little effort. Several studies have shown that students strongly favor the use of such technology. These facts help explain why the use of LCT has increased dramatically in recent years. This paper examines the experience of two business faculty members who used lecture capture technology in their classes. In addition to promoting the use of LCT, we also examined the relationship between lecture capture viewing and student performance on extra credit quizzes. The results suggest that while offering incentives to students did increase viewing of lecture captures, enthusiasm quickly faded, and the impact on quiz performance was not significant. We conclude with lessons learned and suggestions for future research and practice.

Keywords: video capture, student performance

INTRODUCTION

Gone are the days of blackboards and chalk. Today's classroom includes many technological advancements, and many schools offer courses online or in a hybrid format. Audio enhancements are becoming more common, and the use of video capture is on the rise. There are "smart boards" for capturing the day's written lectures and learning management systems to provide easy access to additional resources and communication outside the classroom. And now there are a number of lecture capture systems, such as Echo360, Tegrity, and Accordent, which allow the entire classroom experience to be recorded and reviewed by students and faculty at a later time. This paper presents the results of a project designed to promote student use of lecture capture technology and to measure its effects on learning outcomes.

PREVIOUS RESEARCH

The use of lecture capture technology (LCT) has increased dramatically in recent years (Zhu & Bergom, 2010), and several authors provide overviews of LCT and their experiences using it. Given the relative newness of the technology, current studies often exhibit completely contradictory results. Below are sample studies broken into positive, negative and neutral categories on the impact of the technology. First, the negative outcomes. A column written by an anonymous author in *Business Education* in 2011 records the reasons faculty do not use the new video capture technology. Results of a survey found the reasons for not using included fear of decreased attendance in their live classes, lack of infrastructure and support in case of problems using the technology, and the uncertainty of the market. Basically, faculty were afraid of investing time in learning new technology which would not be supported after a short period of time because a competing product could be supported in the near future. This was an issue at our institution as one product was used for three years, then over the summer term, technical support disappeared in favor of an alternative product.

Cooke, et al. (2010) found that students not surprisingly preferred live lectures to recorded lectures. Recorded lectures were found useful as an introduction to the university for younger students. Bollmeier, et al. (2010) looked at both the number of views and the actual time spent viewing videos. They found no enhanced performance related to watching of videos or time spent watching videos, which is not an encouraging finding given the time required to prepare presentations for video recordings.

Positive responses were found by many other researchers. Although several studies have shown that most students strongly favor the use of podcasts or other LCT (Bongey et al., 2006; Fernandez et al., 2009), what is the impact of their use on learning outcomes? Shaw et al. (2011) found the use of lecture capture-supported techniques resulted in significantly higher student test scores, than achieved historically using traditional techniques without capturing the lectures. Rogers et al. (2011) found similar results, and positive student outcomes were reported using lecture

capture technology from both quantitative and qualitative data analysis. Vajoczki et al. (2011) found not better student outcomes, but increased course satisfaction and better retention of knowledge in courses with traditional lectures augmented by lecture capture. DeSantis et al. (2010) started using video capture technology in their business courses to accommodate student athletes who had to miss class due to games and other events. Although the technology was originally adapted for a subset of students, other students found it useful as well. Dey et al. (2009) focused on the importance of seeing an image of the faculty member, rather than just the PowerPoint slides. Live groups looked at the professor more than the video group. When comparing video techniques, findings suggest that more personalized images are better. Interestingly, they found students captured more knowledge in video vs. when students were in a live classroom. McKee et al. (2008) found that students had a limited attention span. They emphasized that the recordings, be they video or audio, had to "easy to edit" technologies for them to be useful, including both videocasts and podcasts. This finding is echoed by Forbes (2011) who suggests a better use of lecture capture technology is to record small pieces, rather than entire lectures. He further suggests that students themselves enjoyed creating reflective podcasts of video captured material. Smith et al. (2011) used the technology in a different way — rather than capturing faculty lectures, they captured student presentations. Students viewed their presentations made using lecture capture technology, and it was helpful to them to critique themselves and improve in future presentations.

Owston et al. (2011) traced student viewing of captured lectures and compared the viewing patterns to student performance. Interestingly, they found that high achievers view the videos less than low achievers. This may be because they have better study skills as they tend to fast forward through the material with which they are familiar.

In the institution of the authors, an older technology (Camtasia) has been replaced by a newer, easier to use technology (Echo360). From the users' perspective, the major advantage of Echo360 is that it is seamless. Camtasia required an external drive, and the instructor had to follow certain prompts to start the recording. In contrast, Echo360 is scheduled remotely, and does not require any additional action on the part of instructors. In our case, the recordings begin automatically and are stored on a remote server, making it impossible for the instructor to forget to activate the recording.

RESEARCH DESIGN

Despite the fact that students favor the concept, anecdotal evidence in our classes suggests that relatively few students actually make use of recorded lectures. Students have many conflicting demands on their time, and study tools, such as review of video recap of a lecture, all too often fall to the bottom of the activity curve, and few use its capabilities. Upon closer examination of published studies, we find that most statistics regarding LCT are based on students self reporting — that is, the students' perceptions of the technology rather than the actual impact (e.g., Veeramani & Bradley, 2008).

Given the apparent gap between the availability of LCT and the actual use of captured lectures, we designed a small research project that sought to achieve the following objectives:
1. Perform a systematic analysis of if and when students access the captured lectures.
2. Explore methods to increase student use of captured lectures.
3. Evaluate the impact of LCT on student performance.

In brief, the objectives were accomplished as follows. In addition to using video capture, both faculty members made extensive use of a learning management system for posting notes, sending email, and interacting with students on a regular basis. In fact, lecture notes were activated through this learning management system, in our case Blackboard. We monitored the access to course capture through Blackboard. This is easily done using the tracking tools within Blackboard. We then promoted access to the captured lectures to one group of students and did not promote the lectures to a second class of students who we used as a control group. We then assessed the impact of the LCT through before and after surveys, as well as student performance on extra credit quizzes given to the students. Further details of our methods are discussed below.

Each of the co-authors taught teach two sections of the same class in the fall 2011 term. The course is required for all students in the Bachelor of Science in Business Administration degree program. Our first objective was to systematically observe when/if students access the course captures. One study found that students tend to access the material right after the lecture and just before exams (Copley, 2007). Do these results hold for our students? These data were collected by placing links to course capture materials in specific areas of our Blackboard course sites.

Blackboard has extensive tracking functionality, enabling us to monitor precisely what is being accessed, by whom, and when.

The second objective of the project was to study ways to promote student use of captured lectures. To accomplish this objective, each instructor developed ongoing quizzes for their own classes. We administered short, three-question quizzes on course material throughout the semester. Answers to the quiz questions were easily answered by reviewing clues revealed in the captured lectures; however, the answers may not be as obvious to those who have not reviewed the lecture. The quizzes counted for extra credit in all of our classes. Second, we continued to promote the use of Echo360 by providing weekly reminders to the students and offering multiple demonstrations of the technology in one section. The other section (one for each instructor) was given access to the same quizzes, but not the same amount of reinforcement, thus served as a control group.

The third objective of this project is to evaluate the impact of LCT. This objective was achieved by comparing the quiz performance of students in the "active promotion" sections versus the "passive information" sections. While it is not feasible to control for all variables in this situation, this experimental design enabled us account — to some extent — for factors such as instructor ability/style and class day/time. This approach is similar to the recent (and ongoing) work of Cyr (2011).

Hypotheses

The following hypotheses indicate the results that we expected to see from the study:

H1: *Given extra motivation, students are more likely to use course capture technology.* To test this hypothesis we measured average number of accesses ("hits") per week prior to the extra credit quizzes being offered, vs. the average number of "hits" per week once the quizzes were offered. This was independent of whether students took or how well they performed on the quizzes.

H2: *Students will use accessible technology if it is made available.* We did not collect any hard data to test this hypothesis, but instead relied on anecdotal conversations with students.

H3: *Students performance will be enhanced by using course capture technology.* To test this hypothesis we measured the average quiz performance of those who used made at least once access to the technology vs. those who did not use the technology, only evaluating those who attempted the quizzes. We had originally planned on comparing the performance of two sections from each instructor, but this turned out not to work for several reasons.

Data analysis

In one professor's case, five quizzes were given for extra credit. Students were given 24 hours to review the Echo360 recordings prior to the quizzes being made available. Students had to agree that the outcomes of the assessments were completely voluntary to comply with Institutional Research Board (IRB) rules. Interestingly, only 70% of the students agreed that they would participate, even though it simply required them to check a box before proceeding to the quizzes. Of the sixty-six (66) students who agreed to take the extra credit quizzes, on average a little over 40% took the first four quizzes during the allotted time frame. About half that number (20%) took the final quiz, a drop off probably due to exam fatigue and the fact that the quiz was offered the day before a holiday (Thanksgiving).

Some other interesting data can be generated by viewing participation. These data are summarized in the table below:

Table 1: Number of Extra-credit Quizzes Taken

Quizzes taken	Responses [%]
0	18 [27%]
1	11 [17%]
2	12 [19%]
3	12 [19%]
4	8 [12%]
5	5 [8%]

These data suggest that the perceived reward (a maximum of 15 points out of 500, or 3% of a student's grade), was not enough of a motivating factor to even participate in the study. Overall, only 27% (25 of 95) of students even bothered to take more than two of the five extra credit quizzes, lowering the possible sample of students who potentially would watch the Echo360 recordings to a relatively small sample size. In the future, the instructors will have to rethink the "carrot" to the students; that is, how will they entice them to view the recordings. One possibility is to make the quizzes worth more of the grade, or to make the first quiz mandatory so that the student's performance is linked to the review of the recordings. We believe one aspect is to change student behavior, and that once the initial change has been made it is more likely that the students will use this additional tool, even if they do not see an immediate benefit for doing so. In retrospect, the instructor did not reiterate when the quizzes would be available, just indicating at the beginning of one of the two classes, that watching Echo360 may be helpful in responding to the quizzes.

Next we looked at the actual viewing of the Echo360 recordings. The following data is overall. To get a feeling of how many reviewed the video capturing of the lectures, the Blackboard system allows you to identify the tool usage over specific periods of time. The instructor taught on Tuesdays and Thursdays from 12:30 to 3:15PM. Quizzes were made available from 6 to 11PM on the day after a chapter was completed. Thus, we recorded the access to the recordings from noon the day the lecture was completed to 11PM on the day the quizzes were due. Figure 1 shows the number of views prior to each quiz.

Figure 1: Lecture Capture Access Prior to Quizzes
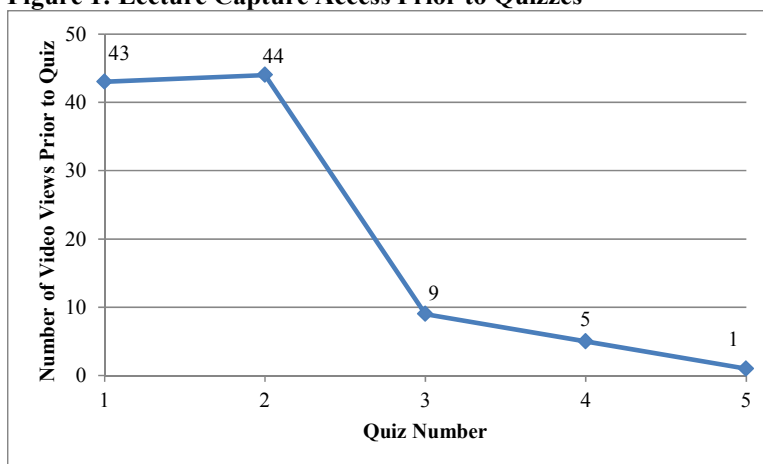
Obviously, for the first couple of weeks after the extra credit assignment was given, there was some enthusiasm for the project. There was a precipitous drop off in viewing the recordings after this time. This result could be because students did not have time or did not see the reward for viewing the recordings. A drop off in tool usage often occurs after the initial enthusiasm for "something new" wears off. A general conclusion is that when using this technical tool as with any other course enhancement, students have to be reminded of its value and availability.

Quizzes were given over material from the second half of the course. A comparison was made to the views over the same time frames earlier in the class, between the finishing of a chapter and midnight the following days. Over similar time frames, there was a total of three views over the entire class. This indicates that at least for this professor, who includes attendance as part of his grade, that either his lectures are so clear that review is not necessary (one which the instructor does not profess), that students do not have the time to review immediately after classes, or that the instructor is unclear making viewing of the lectures a waste of time. This data could be obtained using an anonymous survey in the future. At the very least, it seems that students need some additional motivation to review the lectures.

DISCUSSION

Below we discuss how well the hypotheses were supported.

Hypothesis 1 (motivation to review lectures): The discussion above indicates that students do not readily see the value of this technology on a regular basis. It may be that reinforcement of the key concepts has to be made clearer. It could be that students who are required to come to class do not see the value of revisiting or reviewing the same material. Or, it may be that the professor is ineffective in person, thus reviewing this ineffectiveness is not seen useful. We will have to revisit how to make the technology more useful to students.

Hypothesis 2 (use of technology): One comparison which is interesting is to compare total views between faculty requirements. One faculty member required attendance, the other did not. Anecdotally, based on the conversations after class with some of the better students who the instructor felt comfortable with, students liked the technology for quick reviews. This instructor spent the first couple of minutes each class reviewing what was expected during that period and the following week. A couple of students found this useful but re-viewing the lecture not as useful. In addition, this class was fact-based, rather than problem-solving, in nature. Students indicated that they found the technology to be more useful when reviewing concepts with which they were having trouble, rather than reviewing a general discussion as was the case in this class which was pretty conceptual in nature. The authors did not control for differences in teaching style, which may be an important differentiator.

Hypothesis 3 (impact on performance): The third hypothesis tests the value of the video capture technology. We can get a potential impact by looking at the scores of the students who participated. First, we look at the overall mean score on each of the quizzes, for all students who participated. Note that a score of 3 means students got all 3 questions correct, and a score of 0 means none correct. Overall means for the five quizzes are given below:

Table 2: Overall Performance on Quizzes

Quiz Number	Average Score (out of 3)
1	2.4 [n=28]
2	1.8 [n=31]
3	2.0 [n=24]
4	2.6 [n=29]
5	2.0 [n=14]

Certainly, these five quizzes were not of uniform difficulty. From above, we see that the number of views of the video capture technology dropped off sharply after the first two quizzes, we will compare the scores of those who viewed the lecture capture to those who did not for these two quizzes. Given how the data are captured through Blackboard, this turned out to be a time-intensive procedure, as each individual student had to be examined as to whether he/she viewed the Echo360 recordings during the predetermined time intervals. The results follow:

Table 3: Lecture Viewing and Quiz Performance

Quiz Number	Average Score (out of 3) Viewed video prior to quiz	Did not view video prior to quiz
1	2.4	2.3
2	1.85	1.7

Initial findings show a slight benefit from watching the video, but not a significant difference.

CONCLUSIONS

The authors received a small research grant whose goal was to identify unique ways to try and improve the usage of video capture technology. Our previous experience as evidenced by views as recorded through Blackboard summary data was that students have not used the technology extensively in the past.

The authors decided on using a rewards-based approach. That is, if students viewed the video capture recordings, they would get a reward. In this case the reward was extra credit as measured through on-line quizzes. To access the quizzes, the students had to go through a two step process, first they had to consent to being part of a research project, a step which simply required checking a box. Second, they had to access a three-question quiz, which they could access over a 5-hour (later extended over a 6-hour) time frame. They were given 5 minutes to complete the quiz.

The authors spent a significant amount of time setting up the exercise, starting with compliance with the IRB, setting up the rules for access within Blackboard, creating the quizzes, and then adding the appropriate constraints on the quiz access, including availability (e.g., allowing sufficient time after the class was delivered to process and post the recordings), but soon enough after the class so that there was a direct relationship between the actual class delivery and availability of the recordings and the delivery of the quizzes. Initially we had intended to have a control group, that is one where students were reminded of the quiz availability the other not, but this was not effective because of interclass student communication and inconsistent reminders for the active class.

In addition, the instructor made a conscious decision not to remind students beyond an introductory discussion and email of the upcoming quiz dates. This decision may have been to the detriment of the study as there was a sharp decline in participation between the second and final three quizzes.

These outcomes have led the authors to adjust their thinking for the following term. The following changes will be made.

- Students will be reminded a day in advance of when the quizzes are to be offered.

- Quiz questions will be reviewed by the instructors prior to their lectures. Instructors will make a conscious decision to directly answer the quiz questions during the lectures, with at least one answer being in the first 5 minutes of the lecture, and at least one answer being given in the last 5 minutes of the lecture.

- Quizzes will be lengthened to five questions. Three did not seem to be enough of a "carrot" to get students to participate.

- The first quiz will be easier. This is will be used as a hook to get the students enthused about the benefit of taking the quizzes and watching the lecture capture technology.

- A short survey will be given anonymously to students where we will solicit their opinions on the value of the technology

We feel that LCT has the potential to be helpful to students in the long term. The question remains as to how effectively to get them engaged. One extreme is to prerecord all the classes, so that students do not have to come to class. Another issue is to determine which types of material are best suited for this capture. We will continue to

experiment to see where it may be used to add value to the students while still maintaining the value of the traditional face-to-face instructional methodology.

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