AC 2009-1571: THE EFFECTIVENESS OF ASYNCHRONOUS PODCASTING OF CLASSES

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Abstract

In this study we examine in some detail the effectiveness of enhanced podcasting compared with traditional face-to-face class meeting. Enhanced podcasting goes beyond simply recording the audio portion of a lecture. It may include the video footage from the class meeting or, as in our case, the presented material (including each written pen stroke) exactly as seen by students sitting in the classroom with the instructor. The course we studied is Applied Thermodynamics, a junior-level course for mechanical engineering students. For this study we had access to three sections of the course, all taught by the same faculty member. For a single topic of this course one section was selected to not attend the in-class lectures associated with the topic. Instead, the students in this section were asked to watch the podcasts (recorded from one of the other two regular class meetings) within 48 hours of the scheduled class. The topic lasted for three 50-minute class meetings. At the end of the cluster of classes for this topic, a homework assignment was completed and a quiz was administered (in person) to each student. Our results show that enhanced podcasting appears to be a viable means to replace some face-to-face class meetings, but its many pitfalls outweigh its benefits. Students report a perceived decreased amount of learning that we attribute to the lack of social interactions with peers and instructor and the decreased motivation level to use the podcasts. On the other hand, enhanced podcasting meets the students' overwhelming desire to 'attend class' at the time and place of their choosing. The undeniable benefit of podcasting is its ability to allow students to pause a class for reflection or to replay portions of a class for review.

Introduction

For some time now, technology-enabled teaching methods (e.g., distance learning, virtual/remote laboratories, podcasting, and on-line, hybrid or blended courses) have promised greater efficiencies for education delivery and improved student access, and is purported to better match the learning style and preference of today's students. Few scientifically rigorous studies have been conducted to test the effectiveness of these methods because, most likely, the methods are evolving at a rapid pace as the enabling technologies have evolved or new technologies have emerged and spawned new teaching methods of interest.

In this study we aim to examine a specific technology-enabled teaching method, namely enhanced podcasting, which we define as capturing a lecture, both audio and written notes, for time-delayed playback by students on a computer. This asynchronous learning technology has also been referred to as 'screencasting'[1] or 'lecture capture'[2] and a variety of enabling hardware and software tools are available, as described in the references. This technology is not intended to replace live, face-to-face instruction but is advocated as a viable replacement for when students miss class, as opportunities for class review, or when the instructor has to miss an occasional class meeting. Other benefits that this technology offers is the ability to stop a lecture for reflection or practice, go 'back in time' to review critical information, or to view a class at a

time and place other than the regularly scheduled time. The obvious downsides include the inability to ask questions in real time, interactions with peers or the instructor and lower barriers for procrastination to view a class or to 'skip class' altogether. Traditional and enhanced podcasting have become more popular in recent years as evidenced by the growing content from many universities made available for download from Apple's iTunes U[3] (accessible through Apple's iTunes application).

In the broader view enhanced podcasting is a form of asynchronous electronic-learning (e-learning), which has been more widely studied for their effectiveness.[4] Asynchronous e-learning simply refers to 'time-shifted' learning and teaching on-line through network technologies, and is in contrast to synchronous e-learning, which follows the more traditional model of distance learning. Typically, synchronous e-learning is supported through live communications tools (e.g., audio connection between the instructor and learners, instant messaging, chats) while asynchronous e-learning is supported through e-mail or discussion boards. Many college professors are resistant to either form of e-learning because of fears of poor learning, but in a review of 355 comparative studies across a variety of disciplines, Russell[5] found no significant difference in learning outcomes (as measured by common outcomes such as examination scores or course grades) between traditional and e-learning courses.

Project Design and Implementation

The setting for this admittedly limited-in-scope study is a large, public, technical university. Even given the large student population on campus (>20,000), though, class sizes in this study are relatively small (<40 students per section). This project was implemented in the fall 2008 term in Applied Thermodynamics, a junior-level course for mechanical engineering students that builds on the fundamentals learned in a typical first course in thermodynamics. The author taught three sections of this course, each of which had three 50-min class meetings a week. For a single topic of this course, which lasted for three 50-minute class meetings, one section was selected to not attend the in-class lectures associated with the topic. (The section selected as the 'treatment' group was the only one in which all students agreed to participate in the study and were able to attend one of the other two sections of the course if they wished to do so at any point during the three class periods.) Instead, the students in this section were asked to watch the podcasts recorded from one of the other two regular class meetings within 48 hours of the scheduled class meeting. At the end of the cluster of classes for this topic, all of the students in the course completed a homework assignment by the next class meeting and a quiz was administered (in person) to each student at that time. This format of lectures on a topic, followed by a homework assignment and quiz was the usual procedure throughout the term.

For the entire term, a Tablet PC was used for class presentation using software that permitted the instructor to write directly on the computer screen (which was projected to the class) and into predesigned class notes (Fig. 1). The partially completed notes were always provided to the students before class. During class, the instructor simply used the Tablet PC as a digital whiteboard and completed the notes. A variety of active-learning methods were used with the students including collaborative learning exercises,[6] conceptual questioning[7,8] and skill testing via clickers,[9] and peer instruction.[7,10]

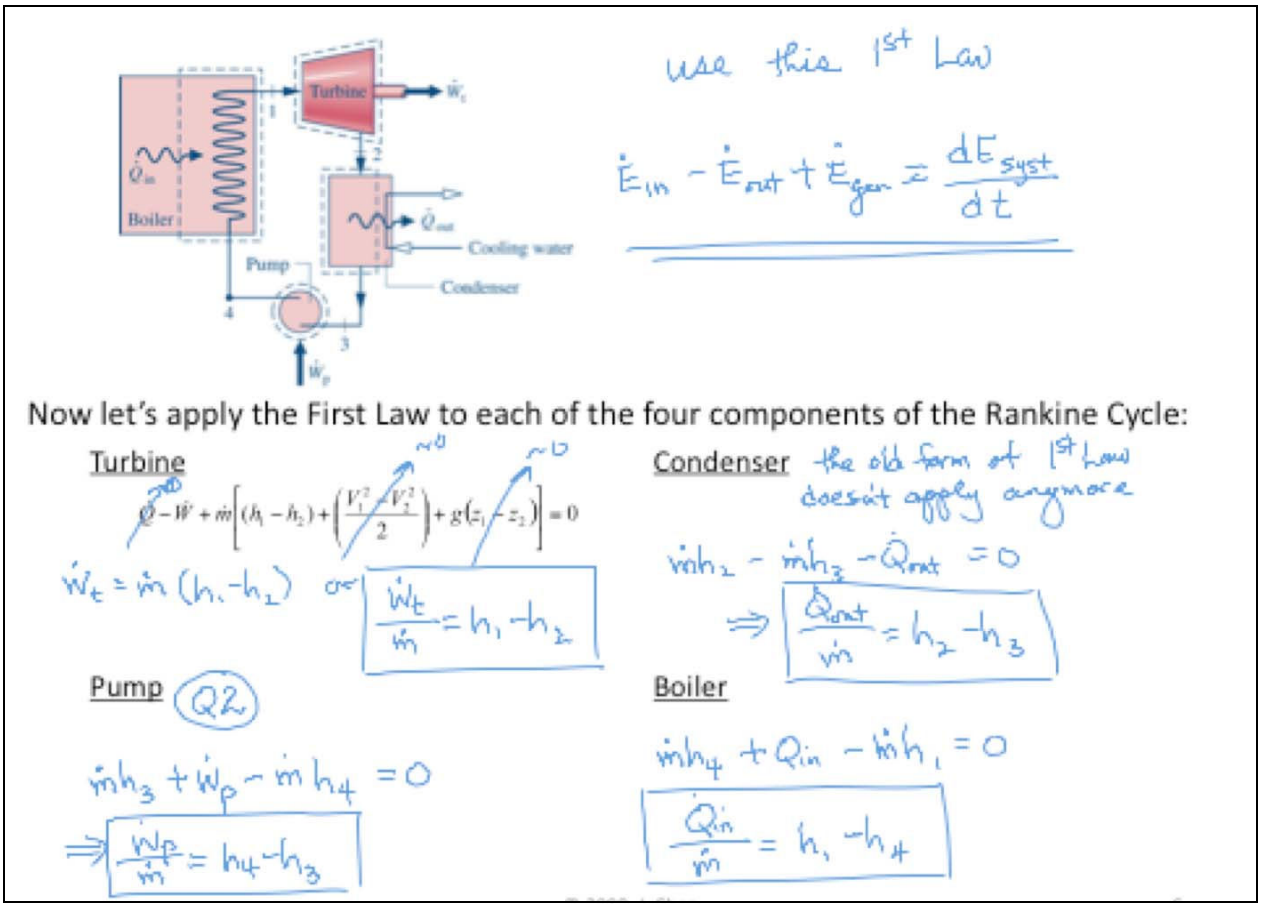

Fig. 1: A representative page of partially completed notes used in class.

Because the Tablet PC was used as the presentation medium, it was relatively straightforward to capture the entire lecture, including the words spoken by the instructor and synchronized to each pen stroke. (We emphasize here that each successive pen stroke was displayed in the podcast, not just the completed page of notes.) The difference between a captured lecture and the live class session was the lack of an instructor (since no video was included), the method by which the presentation was viewed (on a projection screen or a computer screen), and any live interactions with the instructor or peers.

Results

Of the 37 students enrolled in the treatment section, 30 students returned the survey questionnaire administered shortly after the podcast lectures. Of these, three students indicated that they did not watch any of the three podcasts while three others watched only one; the remaining 24 students watched all three podcasts. Of the three students who watched only one podcast, one of them decided to attend the live lectures for the remaining two class meetings. A summary of the survey results is shown in Table 1.

Table 1: Summary of survey questions and responses from the treatment group (N=27 respondents who completed the survey).

1. Compare your level of learning of the material using podcasting with in-person classes.	Much less	Slightly less	The same	More	Can't decide
	3.7%	26%	56%	11%	3.7%
2. Since podcasting eliminated peer and instructor interactions during 'class,' how was your learning experience affected?	Strongly negatively	Slightly negatively	No difference	Slightly positively	Strongly positively
	0%	48%	48%	3.7%	0%
3. Did podcasting affect your time and level of interactions with your peers and professor outside of the normal class meeting times?	No, it increased	No, it was about the same	Yes, slightly less	Yes, significantly less	
	0%	78%	22%	0%	
4. How important was it to be able to watch the podcasts at the place and time of your choosing?	Very important	Somewhat important	Not a factor		
	44%	30%	26%		
5. With the podcasts available instead of having to attend class, what was your level of motivation to watch the podcasts?	Much less	Slightly less	The same	More motivated	
	11%	44%	37%	7.4%	
6. How did you use the podcasts?	Watched them in entirety	Watched only when I needed help, then watched in entirety	Watched only in snippets to get the help I needed	Watched one or two entirely, then the rest in snippets	Watched only one or two, and then attended class in person
	89%	0%	3.7%	3.7%	3.7%
7. Would you like to continue to have class through podcasting?	Yes, definitely	Yes, but not enthusiastically	Yes, if that's the only choice	No, I prefer live classes	
	26%	33%	11%	30%	

The survey also asked the respondents to list positive and negative aspects of having class through podcasting. Among the positives were: Ability to pause or replay podcast (18 respondents listed this), convenience of watching podcast at time and place of choosing (12), and more time during the day for other work (2). Among the negatives were: Lack of interactions with peers and instructor (10), low motivation to keep up with podcasts (10), technical difficulties with podcasts (5), and podcasts not available soon enough (3).

Because the podcasts were posted to a Learning Management System (namely Blackboard) for the students to access, it was possible to monitor the patterns by which the students accessed them. Over 70% of the times when any of the three podcasts were accessed were between 8 pm and 2 am. This clearly showed that, when given a choice, students chose to view podcasts in the evening or late evening, when presumably they are in the general mode of 'studying.'

As described earlier, a homework assignment based on the topic covered during the three lecture or podcasts periods was assigned to all the students in the course (all three sections had the identical assignment). The assignment was submitted at the class meeting immediately following the podcast periods and a quiz was administered to all the students at that time. The performance of the students in the treatment and control groups was compared to look for differences.

When we compared the quiz scores between the treatment section and either of the other two control sections (N=37 and 39) using a t-Test, we found no significant difference in performance ($\alpha = 0.05$). We compared the treatment section with each of the other two sections separately since the podcasts were created from either one of the two control sections (selected randomly), and thus we were concerned there might be differences in performance between the two control sections. Furthermore, when we compared the quiz scores of the treatment section with itself on two previous quizzes, we again found no statistically significant difference, showing that the performance of the treatment group did not decline during the topic covered by the podcasts. Finally, when we compared the quiz scores of the treatment section with the two control sections on two previous quizzes (when everyone attended live classes), the performance between the groups were statistically the same, showing that the treatment section normally was as academically capable as the control sections.

Discussion

Based on the survey results, there is clearly some concern as 30% of the students self-evaluated that they learned less through podcasting (survey question 1). This perceived decrease in learning is likely attributable to (a) the lack of peer and instructor interactions, as evidenced by the responses to survey questions 2 and 3, and (b) the reportedly lower motivation level to watch the podcasts (survey question 5). This inference is supported by the free responses from the students, which frequently cited these two factors as negative aspects of learning through podcasting.

At the same time, however, students highly valued their freedom to learn at the time and place of their choosing (survey question 4), as evidenced by 74% of the students stating that this is important and by the high frequency of citation of this benefit in the free responses. The other

positive finding from the survey is that nearly all (89%) of the students who watched the podcasts did so in entirety. There was concern on our part that students would simply 'skim' them to get the information they needed. Given that only 26% of the students are fully supportive of having classes through podcasting, it is clear that students do not prefer this mode of learning for any extended time.

While the lack of a demonstrable decline in quiz performance was encouraging, it would be safe to surmise that, if podcasting were used as the sole teaching and learning method for an extended time, measurable declines would be seen. The lack of a decline in quiz performance could be attributed to the topic (refrigeration cycles) being similar to and built upon material previously learned (vapor-power and gas-power cycles) just prior to this study.

Conclusion

Our results show that enhanced podcasting appears to be a viable means to replace some face-to-face class meetings, but its many pitfalls outweigh its benefits. Students report a perceived decreased amount of learning that we attribute to the lack of social interactions with peers and instructor and the decreased motivation level to use the podcasts. On the other hand, enhanced podcasting meets the students' overwhelming desire to 'attend class' at the time and place of their choosing, but it is clear that podcasting is not a direct replacement for a face-to-face class. The undeniable benefit of podcasting is its ability to allow students to pause a class for reflection or to replay portions of a class for review. These findings suggest that enhanced podcasting is most beneficial as a supplement to face-to-face class meetings, when it can be used by students who miss class or as a tool for review.

Bibliography

1 EDUCAUSE, "7 Things You Should Know About… Screencasting," EDUCAUSE Learning Initiative, March 2006. Available on-line at http://www.educause.edu/7ThingsYouShouldKnowAboutSeries/7495, accessed Feb. 5, 2009. .

2 EDUCAUSE, "7 Things You Should Know About… Lecture Capture," EDUCAUSE Learning Initiative, December 2008. Available on-line at http://www.educause.edu/7ThingsYouShouldKnowAboutSeries/7495, accessed Feb. 5, 2009.

3 http://www.apple.com/education/mobile-learning/, accessed Feb. 5, 2009.

4 Hrastinski, S., "Asynchronous and Synchronous E-Learning," *EDUCAUSE Quarterly*, 31(4), 2008.

5 Russell, T.L., *The No significant Difference Phenomenon*, 5th ed. (Montgomery, AL: International Distance Education Certification Center), 2001.

6 Felder, R.M., "A Longitudinal Study of Engineering Student Performance and Retention. IV. Instructional Methods and Student Responses to Them," *J. of Engineering Education*, 84(4), 1995.

7 Mazur, E, Peer Instruction: A User's Manual, Prentice Hall, Upper Saddle River, NJ, 1997.

8 Miller, R.L., Streveler, R.A., Nelson, M.A., Geist, M.R., and Olds, B.M., "Concept Inventories Meet Cognitive Psychology: Using Beta Testing as a Mechanism for Identifying Engineering Student Misconceptions," *Proceedings of the 2005 ASEE Annual Conference*, Portland, OR, USA, June 2005.

9 EDUCAUSE "7 Things You Should Know About… Clickers," EDUCAUSE Learning Initiative, May 2005. Available on-line at http://www.educause.edu/7ThingsYouShouldKnowAboutSeries/7495, accessed Feb. 5, 2009.

10 Smith, M.K., Wood, W.B., Adams, W.K., Wieman, C., Knight, J.K., Guild, N., and Su, T.T., "Why Peer Discussion Improves Student Performance on In-Class Concept Questions," *Science*, 323, 2009.