AC 2007-766: PODCASTING THE "INTRODUCTION TO NUCLEAR POWER SYSTEMS" COURSE LECTURES

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Experiment with Podcasting the Introduction to Nuclear Power Systems Course Lectures

Abstract

The ME 337C Introduction to Nuclear Power Systems course is offered every Fall Semester at The University of Texas at Austin. This course is an introduction to nuclear engineering and covers topics ranging from nuclear cross-sections to the diffusion equation. All lectures for this course are digitally recorded and available on the course web site for viewing. A few students participate in this course each year via distance learning.

As part of this course, an experiment was conducted to investigate the utility of podcasting lectures. Since the lectures for this course are already digitally recorded, it was a simple effort to convert the video files to a format suitable for podcasting. The podcasting files were placed on the course website for download by the students in the course. The students in the course could use their own portable media player (*i.e.*, an Apple iPod), or sign one out from the course instructor. Students viewed lectures via podcast and then filled out an on-line survey. The results of this survey are presented and discussed within this paper.

Introduction

ME 337C, Introduction to Nuclear Power Systems, is an undergraduate technical elective offered at The University of Texas at Austin (UT) every Fall semester. It is based on the Introduction to Nuclear Engineering textbook by J. Lamarsh.[1] The course starts out with an introduction to nuclear reactions, and includes such topics as Q values, number densities, cross-sections, and reaction rates. The course then covers the creation of power by nuclear reactions and then focuses on solving the diffusion equation with different geometries and boundary conditions. ME 337C is a pre-requisite for the Reactor Theory I course.

As with all of the Nuclear and Radiation Engineering Program courses, ME 337C is digitally broadcast and recorded for viewing by distance learning students. There are currently ten such students in the Nuclear and Radiation Engineering Program who depend on this technology for content delivery, with one registered in the Fall 2006 ME 337C class.

An experiment was conducted as part of the 2006 Fall semester ME 337C course to introduce podcasting for viewing a single lecture within the course. Onsite students first attended the lecture and then were asked to view it with a portable media player (PMP). The single offsite student was asked to review the podcast lecture after viewing the live webcast from a PC. The students were allowed to download the lecture to their own PMP, or they could sign out an Apple iPod from the course instructor for use. They then filled out an online survey to provide an indication of the ease and usefulness of this new technology for viewing the ME337C lecture. Survey on the Spot software, developed and made available by the UT College of Engineering, was used to design, collect, and report the podcasting survey. Additionally, the students took the Index of Learning Styles Questionnaire online test to determine their learning styles.[2] This test is offered by North Carolina State University at www.engr.ncsu.edu/learningstyles/ilsweb.html and

determines where students' abilities lie on four different learning style continuums: active/reflective, sensing/intuitive, visual/verbal, and sequential/global. The results of this experiment are described in this paper.

Results

The first objective of this experiment was to profile the students regarding their educational background and learning styles. The results below in Figures 1 and 2 represent the students in the Fall 2006 ME 337C class who responded to the survey. Some questions were not answered by all students and these cases will be noted.

Figure 1 shows the results of the Index of Learning Styles Questionnaire. This graph shows which end of four different learning style continuums the students favored. Although the Index of Learning Styles Questionnaire places each student on a continuum for each learning style, the graph below does not show how strongly or weakly the students favored each learning style. It should be noted that many students were measured to lean weakly, measuring from 1 to 3, in many of the learning style continuums that have a maximum index of 11. However, the results can be generalized to say that the students in the class are mostly active, sensing, visual, and sequential learners. Definitions of these learning styles are listed below in Table 1, and the percentages of students measuring weakly (from 1 to 3) for each continuum are reported in Table 2.

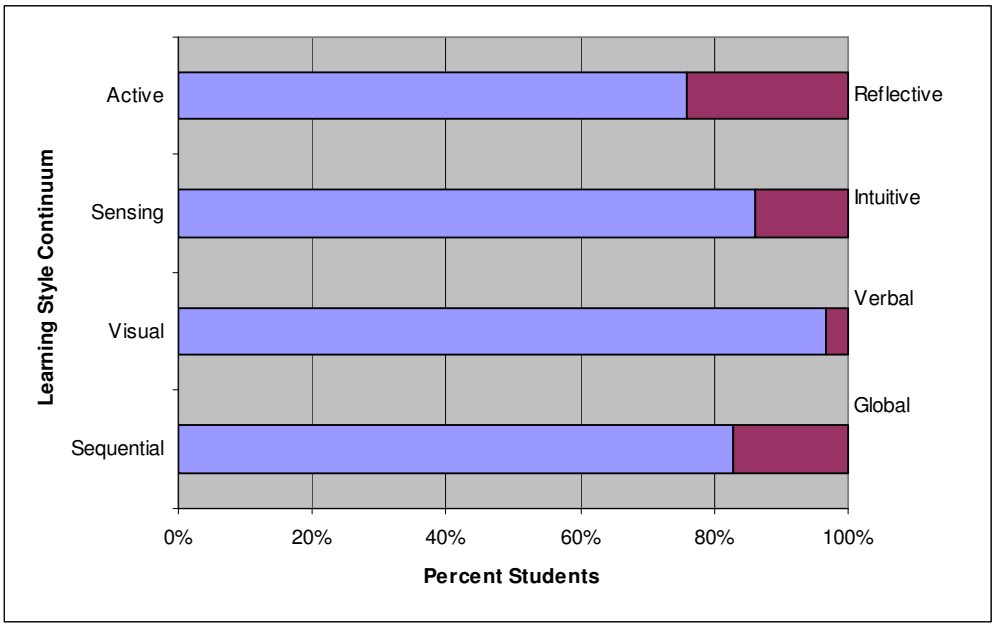


Figure 1. Index of Learning Styles Questionnaire Results (29 of 34 Students Reporting)

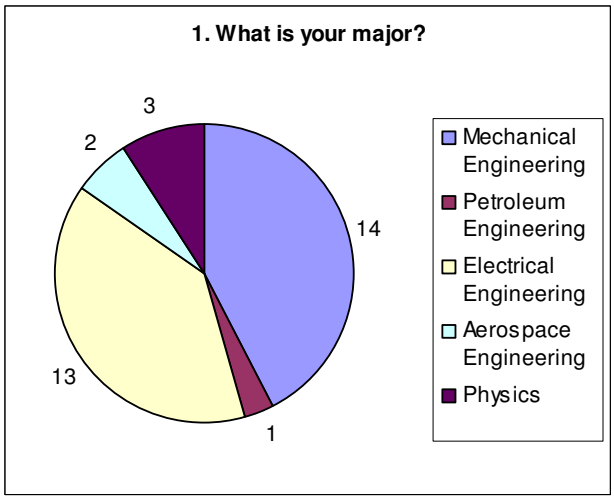
Table 1. Summary of Learning Style Definitions[3]

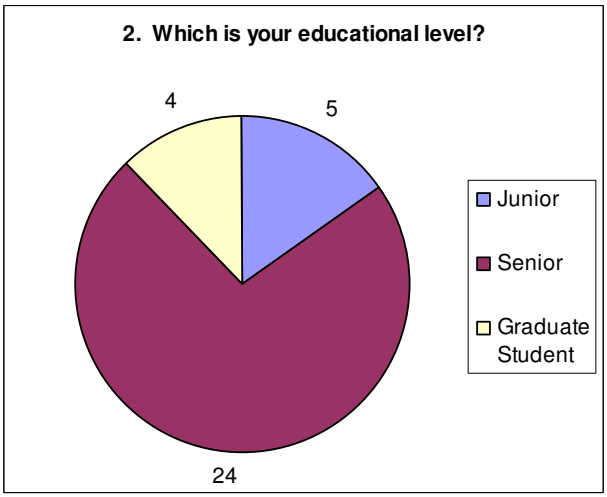
Learning Style Continuum	Learning Styles	
1	**Active:** • Discussing, applying, or explaining information to others • Prefer to work in groups	**Reflective:** • Think about information quietly • Prefer to work alone
2	**Sensing:** • Enjoy learning facts • Like solving problems with well-established methods • Resent being tested on material not covered in class • Patient with details, good at memorizing facts and doing hands-on lab work • Tend to be practical and careful	**Intuitive:** • Like discovering possibilities and relationships • Enjoy innovation • Dislike repetition • Work faster • More comfortable with abstractions and mathematical formulations
3	**Visual:** Remember information best when it is visually displayed in some type of pictorial form	**Verbal:** Remember information best when delivered by written and spoken words
4	**Sequential:** • Understand best when information or problems are displayed in logical, linear steps	**Global:** • Learn in large jumps • Absorb material randomly without seeing connections and then achieving an instant comprehension • Have difficulty explaining how they achieve solutions

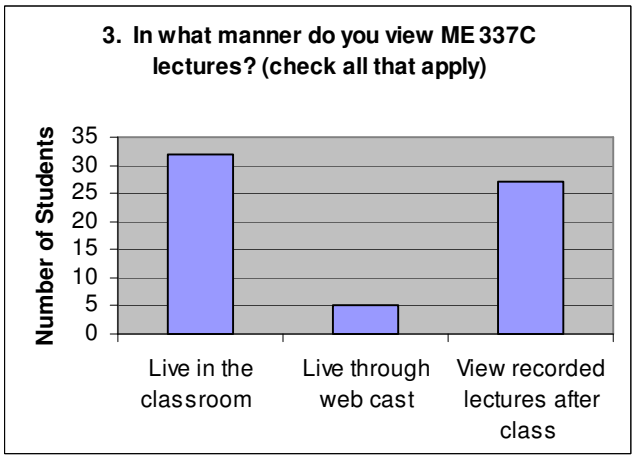
Table 2. Percentage of ME 337C Students Scoring Weakly on Learning Style Continuums

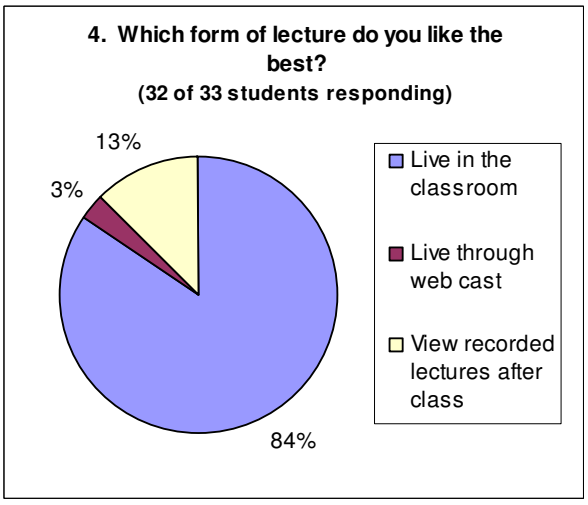
Learning Style Continuum	Percent Students Scoring Between 1 to 3 (out of a possible 11)	Conclusions Regarding ME 337C Students' Learning Style
1. Active/Reflective	69%	Most of the students score weakly as active or reflective learners, i.e., they are more balanced on this learning style continuum.
2. Sensing/Intuitive	48%	Most students are sensing, but there is no pattern regarding where they lie on the continuum.
3. Visual/Verbal	24%	Most of the students score strongly as visual learners.
4. Sequential/Global	66%	Most of the students score weakly as sequential or global learners, i.e., they are more balanced on this learning style continuum.

The next part of the student profiling centered on the students' educational background, as well as their experiences and preferences regarding the current method of digitally recording and viewing class lectures. The results are displayed in the graphs included as Figure 2. Each graph includes the survey question to which it corresponds at the top. Most of the students reported to be seniors (82%) in either mechanical or electrical engineering (73%). Although the clear preference of students was to attend the live class, a large fraction of the students (77%) reported viewing recorded lectures after class, presumably as a study aid. A majority of the students (64%) reported that ME 337C was the only class they attended that offered digitally recorded lectures. However, with 36% of students reporting they have had one or more other classes offering such capabilities, it appears this technology is slowly gaining a foothold in the University. Considering that 66% of the students find digitally recorded courses useful (Question 6) and that 58% watch the recorded lectures more than once (Question 7), the availability of digitally recorded lectures is a natural technological extension of classic pedagogy.









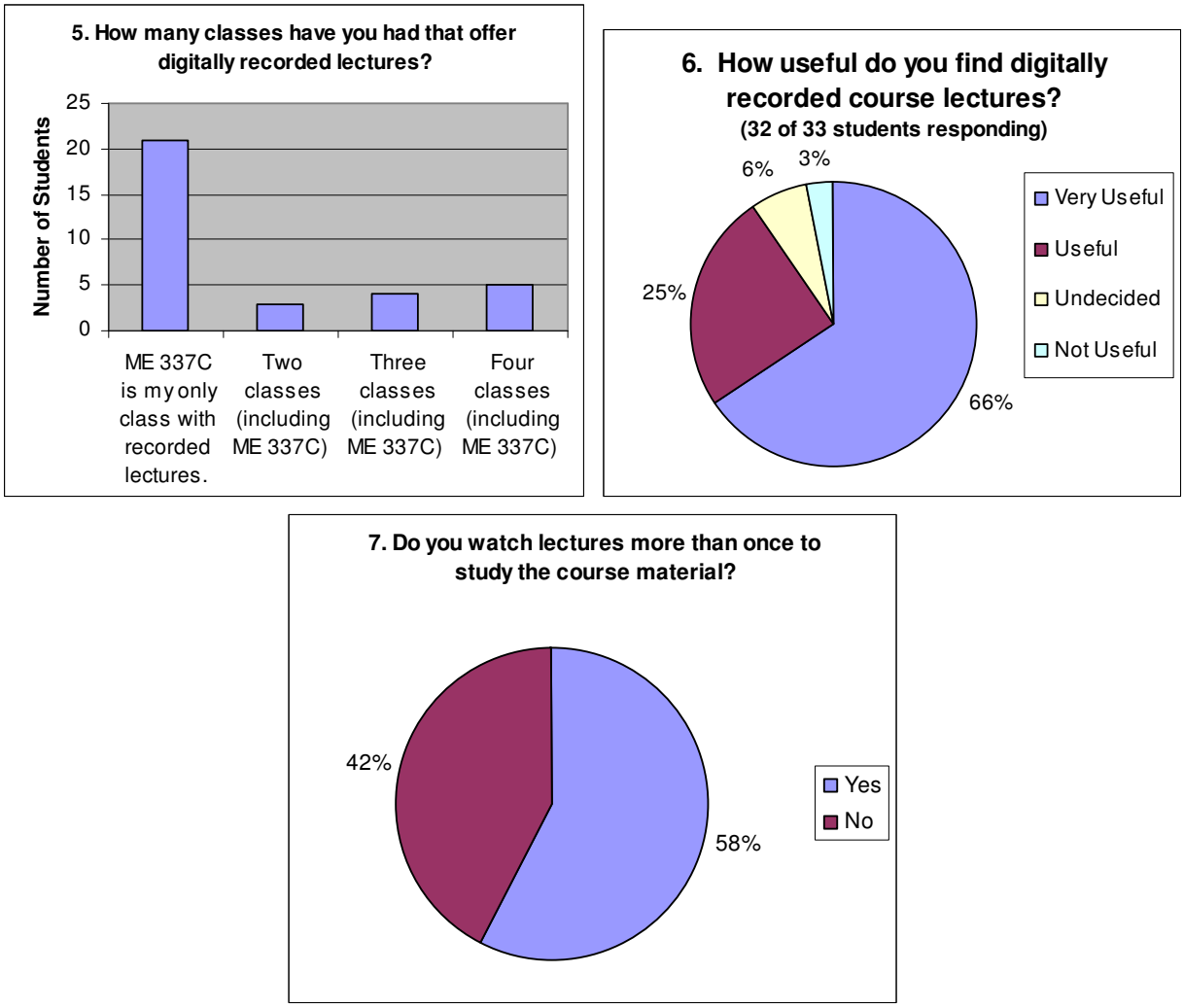


Figure 2. Student Profile Results from the Podcasting Survey: Questions 1-7

The next part of the survey focused on the use of PMPs as a mechanism for class lecture delivery. This consisted of 15 questions, with four questions requiring free-form textual responses from the students. The results of easily quantifiable questions can be found in the graphs comprising Figures 3 and 4. Results of questions requiring free-form responses (Table 3) will be summarized in the paragraphs below.

Table 3. Podcasting Survey Questions Requiring Free-Form Textual Responses

Question No.	Exact Text of Survey Question
11.	Where did you view the lecture? (e.g. in a plane a train a bus or in a park?)
13.	What are some of the benefits of podcasting lectures?
18.	What are some of the negative aspects of podcasting lectures?
19.	What is your overall impression of the podcast lectures?
20.	What is your name (so I can give you credit for your participation in this survey)?

It can be seen from the Question 8 pie graph that a majority of the ME 337C students (61%) do not own their own PMP, however a large minority of students do (39%). More than half the students owning PMPs already use the media viewing capabilities weekly or more frequently (Question 9). A large fraction of responding students, 70%, felt that using the media viewing capabilities of the PMP was easy (Question 10). The most interesting result from Question 11 (Table 3) was the utilization of transportation time (on a bus or plane, walking, waiting in queue) to watch the lecture. Question 12 was included in the survey simply to assess at what times of the day students are working on their studies. Very little activity is going on between midnight and 6:00 a.m., with more and more activity as the day progresses, presumably because students are attending more classes in the morning.

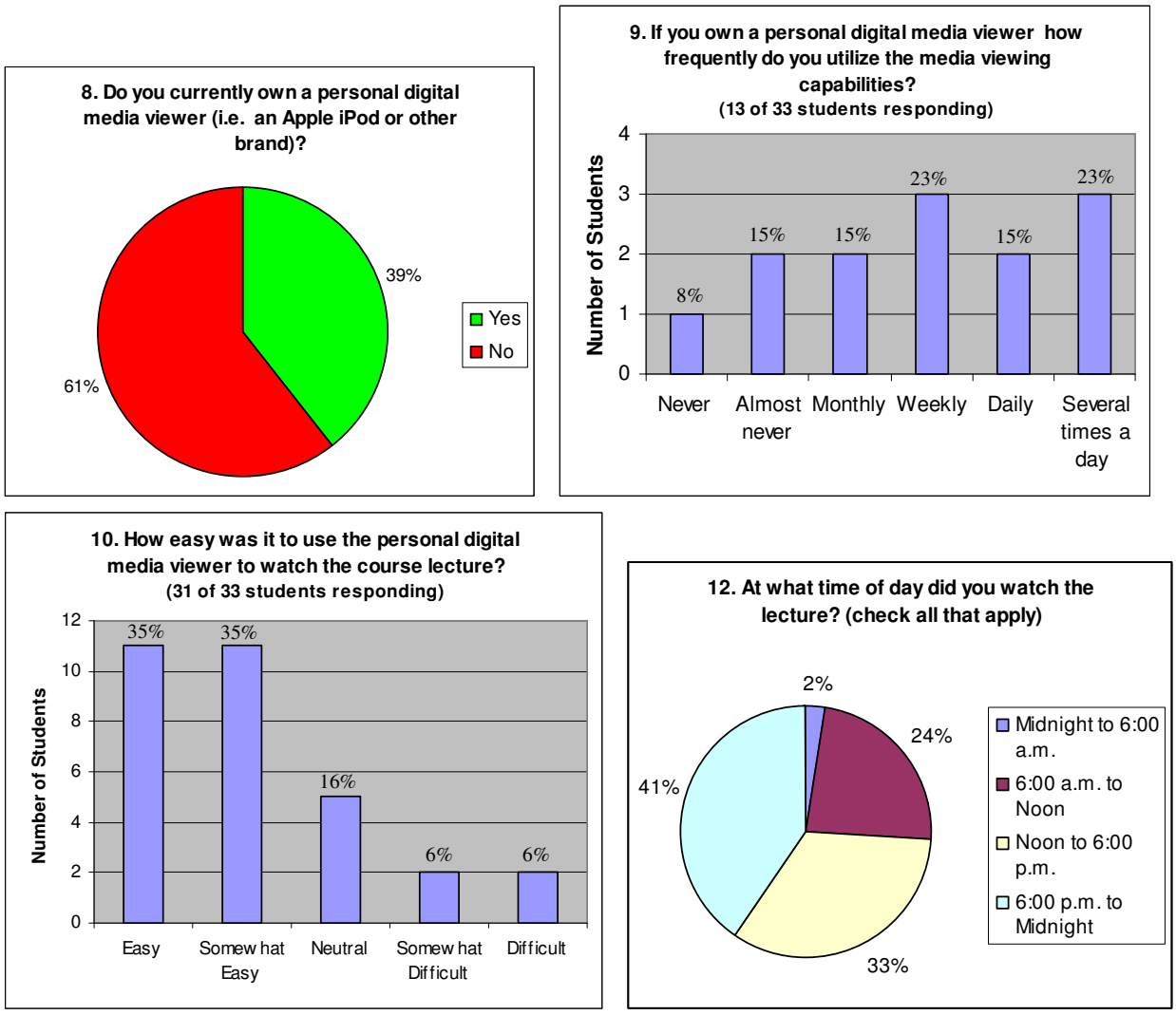


Figure 4. Quantifiable Podcasting Survey Results, Questions 8-10 and 12

Question 13 (32 of 33 students responding) of the podcasting survey asked, "What are some of the benefits of podcasting lectures?", and is one of those questions requiring a free form textual response. The responses to this question can be summarized below.

- PMPs are highly portable.
- PMPs enable lecture content to be available whenever the student desires to access it.

One of the most interesting responses from one of the students was, "I like having the podcasts because I can keep the lectures long after I leave UT." Hence PMPs have the potential to be a course knowledge library.

Graphical results from podcasting survey questions 14-17 are included in Figure 4 below. In Question 14, thirteen of 33 students considered themselves as either "Highly Likely" or "Likely" to use podcasting for viewing lecture content. This is the exact same number of students who own PMPs (Question 8). However, 62% of students who currently own a PMP responded this favorably while only 30% of those without PMPs responded in the same manner. A dismal 24% of the ME 337C students responded that they like viewing podcast lectures better than the way the recorded lectures are currently available (Question 15). Very few students (9%) would go out and by a PMP just to view lectures (Question 16), although price may be one factor in the results to this question. One-third of students felt that podcasting lectures was effective, with almost half (48%) neutral on the subject, and 18% responding that they felt podcasting was ineffectual.

Question 18, "What are some of the negative aspects of podcasting lectures?", required a free-form textural response and the overwhelming negative aspect listed was small screen size. The response to question 19, "What is your overall impression of the podcast lectures?", can be summarized as that podcasting of lectures is nice, but not necessary. It is convenient if a student needs to miss a class. For privacy reasons, results of Question 20 will not be included in this paper, however, the authors would like to personally thank the students for their time in participating in the Fall 2006 ME 337C lecture podcasting experiment.

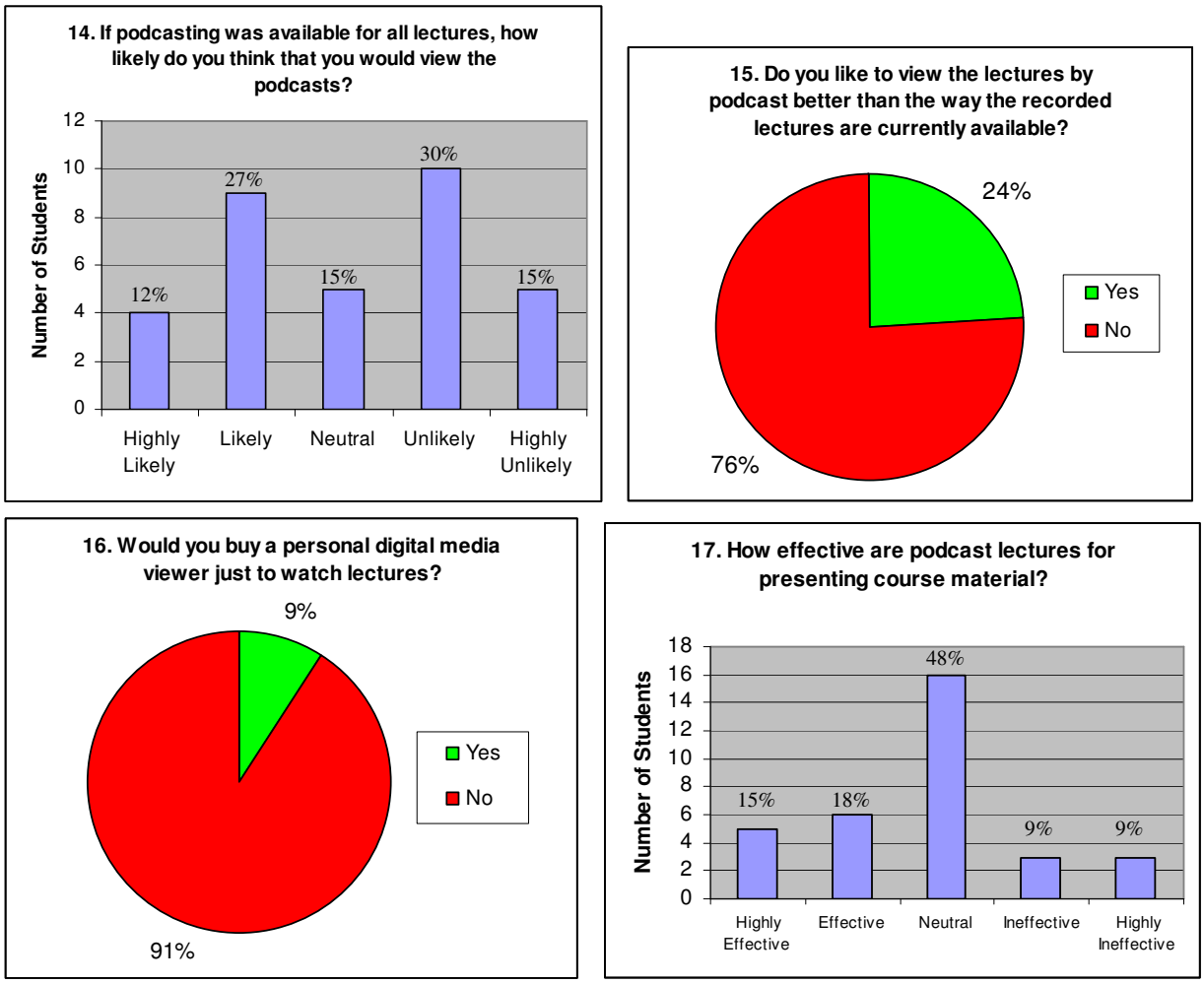


Figure 4. Quantifiable Podcasting Survey Results, Questions 14-17

Discussion

The use of PMPs in a university setting is not a new idea. Since 2004, Duke University has been providing iPods to students either free or heavily discounted, and encouraging their use in courses.[4] Other schools have been using iPods in novel ways to incorporate additional learning material or for recording data to be used in assignments.[4] There has been skepticism in the use of iPods as vehicles of course lecture material.[4] This paper seeks to address this skepticism by providing concrete answers to concerns.

One of the biggest concerns expressed regarding the use of PMPs to deliver course lecture material is that students will no longer attend live classes. In our experience with providing digitally recorded lectures using Blackboard as a way to address the needs of distance learning students, the majority of onsite students still prefer to attend live classes. This preference is repeated by the results of Question 4 of the Fall 2006 ME 337C podcasting survey results. Although PMPs increase the ability of students to access and view material anytime, anywhere, the small screen size prohibits their use as an equivalent to attending the lecture or viewing it online. Considering that most engineering students are visual learners, the small screen size is

the most negative aspect of the current PMP technology. In addition, PMPs may be somewhat cost prohibitive to students. Apple's iPod retails for $249, so unless a college or university wishes to provide cost relief to students, it is impractical to use this technology as a stand-alone course delivery device.

Conclusion

As part of the Fall 2006 ME337C class, Introduction to Nuclear Power Systems, an undergraduate technical elective offered at UT, students were asked to use a PMP to view a lecture that they either attended in person or viewed as a digitally recorded webcast on a PC. They then participated in two surveys: the first being the online North Carolina State "Index of Learning Styles Questionnaire" test to determine their learning styles[4] and the second being another online survey developed by Survey on the Spot software to determine positive and negative aspects of the lecture podcasting experience. The general results of the Index of Learning Styles Questionnaire are that students in the class are mostly active, sensing, visual, and sequential learners, with most students scoring strongly as visual learners. The students already had access to webcasts of previous lectures and use these extensively as a study aide. Because of the strongly visual learning style and the widely used webcasts, it was initially postulated that students would embrace the use of PMPs as another vehicle for class lecture delivery. Although some students strongly enjoyed the podcast lecture, many complained that the screen was too small to see formulas and graphs clearly. A positive aspect of PMPs is that they facilitate time spent traveling to be used as educational. Therefore, with the current PMP technology, it can be said that podcasting lectures is not equivalent to the webcasting experience, however it can be useful when the student does not have access to a PC or a WAN. There is some concern regarding cost, but this can be defrayed through university-sponsored programs.

Because podcasts are publicly available, there may also be issues regarding intellectual property. This would have to be fully investigated under each school's policy. At this point, The University of Texas at Austin is still working on intellectual property concerns for the lectures that may be freely distributed across the Internet. As a result, podcasting lectures is still considered experimental at The University of Texas at Austin and a clear policy for podcasting still needs to be developed.

In conclusion, PMPs hold some promise for delivering course lecture content. Bigger screen sizes, lower costs, and perhaps a way to restrict access to podcasts would increase the usability of PMPs for this application.

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