Interactive Technology In The Classroom: An Exploratory Look At Its Use And Effectiveness

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ABSTRACT

This paper proposes that Interactive Technology can help professors enhance communication, attitudes, and interest in the classroom. This paper describes Interactive Technology, how professors can use it, and preliminary findings of its effectiveness. These findings suggest that the use of Interactive Technology can enhance students' attitudes. Additionally, students surveyed, who had used Interactive Technology in a Consumer Behavior course agreed that its use made the course more interesting and attention getting, and they were satisfied with the course. Preliminary findings, however, also suggest that Interactive Technology may not enhance attendance, course preparation, and retention.

Keywords: Interactive Technology and Audience Response Technology

INTRODUCTION

The quality of interaction and communication between professors and students has consistently been seen as an important component of learning (Karakaya, Ainscough, and Chopoorian, 2001). In a class discussion, however, it is often the same students who participate, even when participation is graded. Additional challenges are keeping students' attention and obtaining useful feedback on students' reaction to the class material (Terreri and Simons, 2005). Furthermore, students are disappointed in a class if it is not entertaining enough for them (Roberts, 1999). Thus, enhancing student interest and input in a course is important for professors. Interactive Technology (also called audience-response systems) is one technological tool that professors can use to enhance communication and interaction in their classrooms (Terreri and Simons, 2005; Eastman, 2007).

As described by Eastman (2007, p. 31), Interactive Technology involves the classroom use of individual response pads by students to answer questions posted via PowerPoint. The professor posts a question via a PowerPoint slide and the students would individually click their responses. On the PowerPoint screen it would note each number pad and whether or not it responded, but would not show any individual responses onscreen. Software could then be used to instantly track responses by an individual student and posts the aggregate results. With this technology, professors get instant, specific feedback and students get the chance to express their thoughts and see what others in the class are thinking (Terreri and Simons, 2005).

The purpose of this paper is to provide preliminary results that illustrate the effectiveness of Interactive Technology and to offer reliable measures with benchmark scores for comparison that could be utilized in future research. As there is little academic empirical research in this area, this paper makes a contribution by reporting exploratory results and providing reliable measures that can be utilized by others interested in measuring the impact of Interactive Technology. As this paper discusses and presents preliminary findings, we utilize research questions rather than hypotheses. Thus, this paper will discuss the use of Interactive Technology, address how faculty can utilize it to enhance classroom communication, and measure its effectiveness.

LITERATURE REVIEW

As described in detail by Eastman (2007) there are several benefits and uses of interactive technology. Kurdziel (2005) notes five reasons for educators to use an audience response system: (1) to address the limitations of traditional lectures; (2) to engage students; (3) to provide feedback to both students and instructors; (4) to effectuate learning gains; and (5) to realize improvements in attitudes. The key benefit of the technology is that it allows both students and professors to get instant feedback (Merritt, 2000). Professors could pose questions at the start of class to determine if the students had read the assigned material or during class to determine if students understood a concept, and could also use the technology for taking surveys on course issues, taking attendance, or testing/quizzing (Kurdziel, 2005). Students know that their opinions are being heard equally, and professors can get immediate feedback on the performance of the class as a whole while tracking individual students behind the scenes to pinpoint specific concerns (Terreri and Simons, 2005) and determine if more time is needed to on a specific topic (Cohen, 2005). Carnaghan and Webb (2005) note the benefit of increasing interactivity regardless of class size, and that the use of Interactive Technology allows professors to focus on problems revealed by the students' responses. Taylor (2007) describes the benefit of utilizing Interactive Technology in large lectures to increase students' active involvement. Finally, Hoffman and Goodwin (2006) note the following benefits of Interactive Technology: ensures interaction, keeps students focused, increases participation, promotes discussion, and increases retention.

BEST PRACTICES WITH INTERACTIVE TECHNOLOGY

Eastman (2007) describes using Interactive Technology for opinion questions (in which any answer was correct) to introduce the topics and highlight the class's opinions, for open-ended questions with students selected at random (using the system's random function) to participate, and for multiple choice questions to measure the students' knowledge of the material and determine if the class was ready to move on to the next topic. Then these questions were on the exams so there was an incentive for the students to make sure they learned the material (Eastman, 2007). There were approximately six to eight questions created per chapter and this participation was worth five percent of the final course average (Eastman, 2007). Additionally, Kurdziel (2005) offers the following best practices with Interactive Technology: (1) the focus should be on using the technology to enhance learning; (2) the portion of the total grade for clicker items should be low (under 10%); (3) the system should be used regularly (two to four questions per class); and (4) exams should measure conceptual understanding and critical thinking. Carnaghan and Webb (2005) suggest using four to six questions with this technology per eighty-minute class. It has been suggested that the questions should be of intermediate difficulty, since students will not feel the need to listen to the lesson if the question is too easy (Kurdziel, 2005; Pelletier, 2004) and, if the vast majority of students answer the questions correctly, those that did not might be reluctant to ask questions about a topic that the majority of their classmates apparently understand (Carnaghan and Webb, 2005). The questions should include various options (i.e., not just yes/no) and opinion questions, as purely factual questions will bore the students (Pelletier, 2004).

THE IMPACT OF INTERACTIVE TECHNOLOGY

While the literature suggests that Interactive Technology can be very useful in gaining the attention and interest of students since it gives them the opportunity to share their ideas in an anonymous way and requires them to respond frequently to the material being presented (Eastman, 2007; Terreri and Simons, 2005), there has been little empirical research on the impact of Interactive Technology on learning (Cohen, 2005). One study comparing different sections of a management course (where Interactive Technology was used in different parts of the course) with a control group found evidence of student satisfaction, with exam improvement only for items closely related to those displayed in class (Carnaghan and Webb, 2005). In a pilot program conducted by an Interactive Technology provider measuring the impact of Interactive Technology on college marketing students, they found the following: (1) 87% of students reported they were more likely to attend class, (2) 72% of students reported they were more likely to participate, (3) 61% of students reported they were more focused on the lecture, (4) 70% of students reported they improved their understanding of specific concepts, and (5) 63% of students reported that class was more fun (Anonymous, 2006, p. 1). Fitch (2004) found that students liked using Interactive Technology. Finally, Simpson (2007) reported that a survey of students at one university found that three out of four students are satisfied with the use of the Interactive Technology.

Since research on Interactive Technology in the classroom is so scarce, the current study was exploratory in nature. Thus, the focus of this study was to ask general research questions rather than test formal research hypotheses. These questions all focus on the attitudinal and behavioral aspects of students toward the use of Interactive Technology in the classroom and are as follows.

Research Question 1: Will students report a higher attitude score for the subject matter in a course after it is taught with Interactive Technology?

Research Question 2: Will students report a higher attitude score regarding the use of Interactive Technology after they have used it in a course?

Research Question 3: Are courses that use Interactive Technology seen by students as more interesting than courses that do not use Interactive Technology?

Research Question 4: Are courses that use Interactive Technology seen by students as more attention-getting than courses that do not use Interactive Technology?

Research Question 5: Will students report being more satisfied with a course using Interactive Technology?

Research Question 6: Do courses using Interactive Technology encourage students to make more of effort to attend class?

Research Question 7: Do students feel more prepared for a course using Interactive Technology than for other courses?

Research Question 8: Does Interactive Technology result in students perceiving they have retained the subject materials more than in courses where Interactive Technology is not used?

METHODOLOGY

The eight research questions were addressed in two different ways: through pre- and post-survey measures done at the start and the end of the semester for the sections of the Consumer Behavior course where Interactive Technology was utilized, and through additional post-survey measures at the end of the semester for those sections where Interactive Technology was utilized.

MEASURES USED

Survey items were utilized to measure the research questions. The majority of these pedagogical measures combined items either created by the authors or adapted from other pedagogical research. Several of the items came from a working paper by Carnaghan and Webb (2005), who measured the impact of the use of Interactive Technology in accounting education. Several items from Kurdziel (2005) looking at the impact of Interactive Technology in large biology lectures were also utilized. Another source was Seay, Rudolph, and Chamberlain (2001), who used items measuring perceptions of interactive television instruction. Finally, some of Massey, Brown, and Johnston's (2005) items measuring the impact of using games (such as crossword puzzles and Jeopardy) to review materials were also adapted. The specific sources utilized for the various measures are described in more detail below.

The first approach examined research questions one and two (attitude towards the subject matter and attitude towards the use of Interactive Technology in the course) for the three sections of Consumer Behavior that were taught after Interactive Technology was utilized. Attitude towards the subject matter was measured by comparing attitude scores towards the subject of Consumer Behavior pre (the first day of class) and post (the last day of class). The thirteen-item attitude measure was adapted from that used in Economics (Agarwal and Day, 1998) with the subject "Consumer Behavior" substituted for "Economics" and scored on a five-point Likert scale. Attitude

towards the use of Interactive Technology was measured with twelve items; seven adapted from Carnaghan and Webb (2005) along with five items created by the authors.

The second approach examined research questions three through eight using additional measures included in the post-survey done the last day of the semester for the three sections of the Consumer Behavior course utilizing Interactive Technology. Given the exploratory nature of the study, the intent in looking at these six research questions was to establish reliable measures and a benchmark mean score for use in later studies. Interest in a course utilizing Interactive Technology (research question three) was measured with six items. Three of these items were adapted from Seay, Rudolph, and Chamberlain (2001) and three were created by the authors. Attention generated in a course using Interactive Technology (research question four) was measured with twelve items. One item was adapted from Seay et al. (2001), one item was adapted from Kurdziel (2005), one item was adapted from Massey, Brown and Johnston (2005), six items were adapted from Carnaghan and Webb (2005), and three items were created by the authors. Satisfaction with a course utilizing Interactive Technology (research question five) was measured with ten items. Five of these items were adapted from Oliver (1994) and five were adapted and modified from Cole and Balasubramanian (1993), Arnould and Price (1993), and Fisher and Price (1991).

Attendance (research question six) was reported with two items created by the authors that focused on whether the students made more of an effort to come to the class utilizing the Interactive Technology. The students' preparation efforts and perception of whether the Interactive Technology was helpful in preparing them for the course (research question seven) was measured with eleven items. Two items were adapted from Seay et al. (2001), three items were adapted from Kurdziel (2005), four items were adapted from Carnaghan and Webb (2005), and two items were created by the authors. Finally, the students' perceived retention of the subject material through utilizing Interactive Technology (research question eight) was measured with seven items. One item was adapted from Seay et al. (2001), three items were adapted from Massey et al. (2005), two items were adapted from Carnaghan and Webb (2005), and one item was created by the authors. It needs to be noted that all our survey items were on a five-point Likert scale with strongly disagree/strongly agree endpoints for the sake of consistency. The survey items were reviewed by several business faculty members for face/content validity. All of the final items utilized in the surveys are listed in Table 1 along with the source for each particular item and their reliability scores.

Table 1

Scales/Items Utilized	Mean	SD	Reliability
ATTITUDE TOWARDS THE COURSE (PRE/POST)	3.560/3.720	.500/.590	0.87/0.88
I enjoy reading articles about Consumer Behavior topics. [f]			
Consumer Behavior is easy for me to understand. [f]			
I enjoy Consumer Behavior. [f]			
On occasion I read an unassigned book in Consumer Behavior. [f]			
Consumer Behavior is one of my favorite subjects. [f]			
I use Consumer Behavior concepts to analyze situations. [f]			
Consumer Behavior is practical. [f]			
I hate Consumer Behavior. [f,r]			
Consumer Behavior is dull. [f,r]			
Consumer Behavior is a very difficult subject for me. [f,r]			
Studying Consumer Behavior is a waste of time. [f,r]			
Consumer Behavior is one of my most dreaded subjects. [f,r]			
Consumer Behavior ideas are dumb. [f,r]			
ATTITUDE TOWARDS INTERACTIVE TECHNOLOGY IN COURSE (PRE/POST)	3.927/4.176	.639/.724	0.88/0.88
I thought this course did focus too much on using the response pads. [c,r]			
I thought the lecture and response pad usage were effectively integrated. [c]			
I thought the response pads were not easy to use. [c,r]			
I had enough time to answer the questions with the response pads. [c]			
I was not confident that the response pads accurately recorded my responses. [c,r]			
Overall I thought, the advantages of using response pads outweighed the disadvantages in this course. [c,r]			
I think the response pads should not be used in other courses. [c,r]			
I liked using the Interactive Technology in this class. [e]			

I think the use Interactive Technology in this class was childish. [e,r]
I think the use of Interactive Technology in this class was stupid. [e,r]
I think this course should continue to use Interactive Technology. [e]
I think other professors should use Interactive Technology in their courses. [e,r]

INTEREST IN A COURSE USING INTERACTIVE TECHNOLOGY	4.2567	.688	0.87

If I had a choice between a course taught with Interactive Technology or taught in a traditional setting, I would select the course using Interactive Technology. [a]
The course material was presented effectively. [a]
I enjoyed using the response pads to answer the questions in this course. [a]
This course was more interesting than I thought it would be. [e]
The use of Interactive Technology made this course less interesting. [e,r]
I think more professors should use Interactive Technology to make their courses more interesting. [e]

ATTENTION GENERATED BY INTERACTIVE TECHNOLOGY	4.0906	.594	0.85

The Interactive Technology increased classroom participation significantly. [a]
I pay more attention to what is going on in lecture when conceptual questions will be presented and I can respond with Interactive Technology. [b]
The Interactive Technology was a fun way to review class materials. [d]
I felt comfortable participating in this course. [c]
I did not feel comfortable asking questions in this course. [c,r]
I had trouble paying attention in class. [c,r]
I felt comfortable answering oral questions in this course. [c]
I was not required to think much in class about the course concepts. [c,r]
The response pads made me feel more comfortable participating in the course. [c]
This class, with Interactive Technology, kept my attention more than my other marketing classes. [e]
I paid less attention in this class than I usually do in classes. [e,r]
Knowing that I would have to respond throughout the class made me pay more attention in class. [e]

SATISFACTION WITH INTERACTIVE TECHNOLOGY	4.035	.737	0.94

My experience at using the Interactive Technology was good. [h]
I am happy that this course used Interactive Technology. [h]
My trial of the Interactive Technology worked out well. [h]
I am sure it was the right thing to use Interactive Technology. [h]
This is one of the best courses I have taken. [g]
This course has worked out well. [g]
I am satisfied with my decision to take this course. [g]
I have truly enjoyed this course. [g]
I am happy that I took this course. [g]
Taking this course has been a good experience. [g]

ATTENDANCE FOR THE COURSE	3.7304	.974	NA

I attended more of this class than other classes that I also took this semester. [e]
I made less of an effort to attend this class than I did other marketing classes that I took this semester. [e,r]

PREPARATION FOR THE COURSE	3.465	.480	0.70

Discussing the Interactive Technology questions helped me learn the material. [b]
Discussing the Interactive Technology questions helped me realize which concepts I needed to spend more time on when I prepared for exams. [b]
I believe that taking a course using Interactive Technology required significantly more preparation time for me outside of class than does a course offered in a traditional setting. [a,r]
The Interactive Technology helped me prepare for exams. [b]
Seeing the summarized class answers to response pad questions helped me track my progress in the course. [c]
The instructor clarified and explained the correct solution for questions answered with the response pads when a significant number of students had difficulty determining the correct answer. [c]
Knowing the response pads were going to be used encouraged me to work harder to answer questions in class. [c]
Knowing the response pads were going to be used encouraged me to work harder to prepare for class. [c]

I read the assigned chapters before class. [e]
I spent more time studying for this class than I did for other courses. [a]
This course was less time consuming than I thought. [e,r]

RETENTION OF INFORMATION USING INTERACTIVE TECHNOLOGY	3.667	.796	0.90
I believe I learned more in this course using Interactive Technology than I would have learned in a traditional setting. [a]			
The use of Interactive Technology increased my understanding of basic concepts. [d]			
The use of Interactive Technology helped me learn factual material. [d]			
The use of Interactive Technology helped me identify issues central to the course. [d]			
The classes helped me master the course material. [c]			
Using the response pads did not help me learn the material in this course. [c,r]			
I learned more in this class than I learned in my other marketing classes. [e]			

Sources used to measure the scale

[a] Seay, Rudolph and Chamberlain (2001)
[b] Kurdziel (2005)
[c] Carnaghan and Webb (2005)
[d] Massey, Brown and Johnston (2005)
[e] New (created by the authors)
[f] Agarwal and Day (1998)
[g] Oliver (1994)
[h] Cole and Balasubramanian (1993); Arnould and Price (1993); Fisher and Price (1991)
[r] Reverse Coded items

SAMPLE

The sample consisted of students in three sections of a Consumer Behavior course. Enrollment in the post group ranged from 32 to 48 students with a mean enrollment of 37.667 students (standard deviation of 8.962). The group members were given pre- and post-surveys to measure the research questions. The pre-survey was given during the first week of class and the post-survey was given the last week of class. The students received one point of extra credit to their average grade in the course if they completed both surveys. The students did not put their name on either survey; rather, they signed a separate sheet after completing the surveys for the purpose of recording extra credit. After the course was completed, pre- and post-surveys were matched up utilizing the last four digits of the student's id number listed on the survey. Due to students adding the course late, dropping the course, or missing class the day of the surveys, there was some attrition. For the three sections of students, there were seven pre-surveys for which there was no post-survey completed and six post-surveys for which there was no pre-survey completed. Only surveys in which there were both a pre- and post-survey completed were analyzed.

A total of 97 students completed the questionnaire at both stages (pre/post). Approximately 55% of the respondents were females. All were either juniors or seniors in college (40% juniors, 60% seniors). The majority (64%) of the respondents were marketing majors, but 11% were management majors and 25% were double majors (marketing/management, marketing/finance, other). While most of the respondents (59%) were employed between 10 and 40 hours per week, 31% of the sample was not employed. The respondent sample engaged in approximately 2-4 hours of study time per course per week. On being asked how often these students prepare for any course, the highest percentage of response was "often (50%)" followed by "sometimes (39%)." The mean GPA of our respondents was 3.0.

RESULTS

Research question one related to whether students report a higher attitude rating for a subject that is taught using Interactive Technology. This was measured by comparing the attitude of students about the subject matter of Consumer Behavior at the start of the course utilizing Interactive Technology to their attitude at the end of the term. The mean scores (standard deviation) for attitude toward the subject matter at the start of the semester was 3.56 (.50) and the mean score (standard deviation) at the end of the semester was 3.72 (.59). The differences between the two time periods was measured using a t-test and the t-value was 2.834 ($p<0.001$), which was significant. This indicates that the attitude towards the subject matter in a course using Interactive Technology increased over time.

Research question two examined whether students reported a higher attitude rating for Interactive Technology after utilizing it for a course. The mean scores (standard deviation) for attitude toward Interactive Technology prior to using it was 3.927 (.639) and after using it was 4.176 (.724). The differences between the two time periods was measured using a t-test and the t-value was 3.034 ($p<0.001$), which was significant. This indicates that the students' attitudes towards using Interactive Technology increased after they had used it for the semester.

Research question three measured student interest in a course utilizing Interactive Technology. The mean score of 4.2567 with a standard deviation of .688 indicates that students, on average, agreed that they were interested in a course using Interactive Technology. Research question four addressed whether students paid more attention to a course that utilizes Interactive Technology. The mean score of 4.09 with a standard deviation of 0.59 indicates that students, on average, agreed that they pay more attention in a course that uses Interactive Technology. Research question five measured the students' satisfaction with a course that utilized Interactive Technology. The mean score of 4.035 with a standard deviation of .737 indicates that students, on average, agreed that they were satisfied with the course and its use of Interactive Technology.

For the last three questions, the students' mean scores were fairly neutral. Research question six measured the reported attendance effort for the course using Interactive Technology. The mean score for attendance was 3.73 with a standard deviation of 0.97. This indicates that, on average, the students were fairly neutral regarding whether a course utilizing Interactive Technology enhanced attendance. Research question seven measured perceived preparation in a course using Interactive Technology. The mean score for preparation was 3.46 with a standard deviation of 0.48. This indicates that, on average, the students were fairly neutral regarding whether a course utilizing Interactive Technology enhanced preparation. Finally, research question eight measured the perceived level of retention for a course using Interactive Technology. The mean score for retention was 3.66 with a standard deviation of 0.79 indicating that, on average, the students were fairly neutral regarding whether a course utilizing Interactive Technology enhanced retention.

CONCLUSION

The purpose of this paper is to be an exploratory work examining the impact of Interactive Technology in the classroom. Even as an exploratory work, this paper makes a significant contribution to the literature by demonstrating the potential effectiveness of Interactive Technology as a pedagogical tool. The results suggest that while Interactive Technology may not be able to improve all aspects of learning and the classroom experience, there are significant benefits to adopting Interactive Technology. Thus, the benefits of Interactive Technology exceed the costs, particularly when considering the enjoyment of students in class and developing an active learning environment (Hoffman and Goodwin, 2006).

Through the use of pre- and post-survey measures at the start and end of the semesters using Interactive Technology, the authors demonstrate that the students' attitude toward both the subject matter and the use of Interactive Technology is increased. Through the use of post measures taken at the end of the semesters using Interactive Technology, the authors provide a benchmark that suggests, on average, students agree that a course using Interactive Technology is more interesting, more attention getting, and more satisfying. Finally, however, it does need to be noted that our analysis of the research questions indicates that Interactive Technology does not solve all classroom problems. The initial results suggest that students are only neutral on whether Interactive Technology impacts attendance, course preparation, and retention.

As an initial study, there are several limitations that additional research would need to address. First, the authors initially planned to conduct this study as a field study experiment, with one section of the course utilizing Interactive Technology and the other section not using it. Both sections were to have the same instructor with identical material, in-class questions, and tests. Unfortunately, due to the fact that students would need to purchase materials to use the Interactive Technology, there was concern that those students who incurred the additional expense would complain to the administration and request being moved to the other section.

Much more research is needed with a variety of faculty and with a variety of business courses to determine the effectiveness of Interactive Technology in the classroom. For example, Taylor (2007) notes there is concern though that while it appears that students and teachers like the Interactive Technology, it is not clear if it is

enhancing learning A significant contribution of this paper to the literature is the development and organization of reliable measures that can be used in future research studies to measure the effectiveness of Interactive Technology. This paper hopes to contribute to the literature by initiating discussion and further research on this important topic.

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