

The Effects Of Student Response Systems On Performance And Satisfaction: An Investigation In A Tax Accounting Class

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ABSTRACT

Does the use of student response systems (clickers) in the classroom increase student performance on exams? Do students perceive a benefit to using clickers in the classroom? This study investigates the effect of student response systems on accounting students' learning outcome and perceived satisfaction. Results show that, though the use of clickers may not always help students do better on exams, clickers are a useful pedagogical tool that can help students pay attention in class and be more involved in a learning friendly environment.

INTRODUCTION AND BACKGROUND

*A*lbrecht and Sack (2000) in their assessment of accounting education change at the turn of the millennium indicate that the pedagogy in every class should be considered with emphasis on moving away from delivery methods that "...rely too much on lecture and memorization" and toward delivery methods that "...include some elements of group work to teach leadership and working together." One example they offer is providing quizzes immediately after mini-lectures to improve communication and listening skills.

They also alert us to the idea that, "technology has revolutionized everything, including the way we live and work. It should have caused us to rethink everything we teach ..."

One way to use technology to provide students an opportunity to work together in groups is the use of the student response system. Student response systems, also known as clickers, imitate game show technology which enables students to use a keypad to respond to questions posed in a PowerPoint presentation in class. Once the histogram of the class answer is shown, students can then go to work in groups or teams to determine their answer to be given when the same question is displayed for the second time in PowerPoint.

Madigan (2006) describes the potential for student response systems by indicating that even though student response systems have been around for more than two decades, today's model provides low cost installation and operation along with portability which is much improved from earlier models. Madigan goes on to say that using the student response system can expand the pedagogy of active learning since it provides students an opportunity to interact and post group responses. He also cites that teachers report that the student response systems provide increased student participation, better attendance, and better motivation and course interest. He concludes that more research needs to be done to verify these effects.

Early use of student response systems focused on the operant conditioning effect of providing immediate feedback to students and providing the instructor a way to pace their lecture based on student responses (Judson and Sawada, 2002). More recent studies affected by constructivist cognitive science have used student response systems to bring about more student-to-student and student-to-instructor discussion (Abrahamson, 1998; Dufresne, Gerace, Leonard, Mestre, & Wenk, 1996; Poulis, Massen, Robens, & Gilbert, 1998; Shapiro, 1997). Findings of recent studies indicate that students enjoy using student response systems and find them useful for understanding subject

matter (Dufresne et al., 1996; Shapiro, 1997). Contemporary reports from the *Chronicle of Higher Education* (Carnevale, 2005) and *New York Times* (Hafner, 2004) provide anecdotal evidence about using this popular student response technology to engage students in the classroom. However, whether student response systems bring about academic achievement has yet to be determined. Studies reporting academic achievement have been limited to the discipline of physics where the pedagogy promoted interactive student engagement (Judson and Sawada, 2002).

Bryant and Hunton (2000) inform us that “the accounting literature offers relatively little research on the pedagogical benefits of using technology to deliver instruction.” Yet they go on to point out that education technology (ET) research is extensive in the areas of education and psychology. Rebele et al. (1998) provide a helpful way to classify ET by setting up a model using two major types of ET, Computer Based Learning and Other Technologies and providing a list of ET studies published in accounting education journals (1991-1997) by ET type. Bryant and Hunton update the Rebele model by including more studies up to midyear 1999. One observation made by Bryant and Hunton suggests that ET research has moved toward distance learning and interactive multi-media.

Kaletka and Joosten (2007) surveyed over 2,600 students and 27 faculty members in four different universities of the University of Wisconsin system. They found that the majority of faculty and students agreed that the clickers increased student engagement in the classroom, and increased the frequency of student participation in class.

This study will add to the research of the pedagogical benefits of using technology to deliver instruction. Specifically the present study will examine the performance dimension of clickers to determine if student use of clickers in the classroom improves their exam scores on similar questions. In addition, the student satisfaction dimension will be examined to shed light on the perceptions of clicker effectiveness by class and inter-university.

METHOD AND HYPOTHESES

Clickers are used as a pedagogical tool in four undergraduate tax accounting classes (see Table 1). Students use clickers to answer a number of multiple choice questions that are displayed on a PowerPoint screen in front of the classroom. The student engagement begins once the histogram of student responses is displayed on the next PowerPoint screen. Collectively, the histogram informs the class whether they correctly understood the recently taught concept. When incorrect responses are displayed it provides the student an opportunity to talk to their neighbor, student-to-student interaction, before being re-polled on the same question. Whenever appropriate, the instructor will further illustrate the underlying concept and perhaps lead a class discussion before he moves on to the next subject.

In order to empirically examine the impact of using technology to facilitate college students’ learning, students in the 9:30 am section of a tax accounting class were given nine multiple choice questions (Question Set 1) that are related to an important tax accounting concept they have learned over three weeks in preparing for their third tax exam when they have been familiar with using the clicker in class for more than two months in a 16-week-long semester. Similarly, students in the 11:00 am section of the same course were provided nine different clicker questions (Question Set 2). This procedure was used across two undergraduate tax accounting classes over two consecutive semesters described in Table 1 below. Specifically, we attempt to measure the effect of clickers on students’ learning outcome by examining whether there is a significant difference in terms of how well students are able to answer the nine related multiple choice exam questions between the with-clickers and without-clickers settings.

Table 1: Question Sets used for each class, clicker condition by semester by class.

Fall 2005 & Spring 2006

	Question Set 1	Question Set 2
9:30 class	A	B
11:00 class	B	A

A: For a specific tax accounting concept, clickers were used during class discussion.

B: For a different tax accounting concept, clickers were not used during class discussion.

Therefore four hypotheses are:

- H1:** The higher the student’s cumulative GPA, the higher the student’s exam performance in the tax accounting class.
- H2a:** Students who answered and discussed a specific tax accounting concept using clickers in class (measured by Question Set 1 in the exam) did not perform significantly better on a set of nine related exam questions than their counterparts who were exposed to the same tax accounting concept without being surveyed using the clickers in class.
- H2b:** Students who answered and discussed an equally important but different tax accounting concept using clickers in class (measured by Question Set 2 in the exam) did not perform significantly better on a set of nine related exam questions than their counterparts who were exposed to the same tax accounting concept without being surveyed using the clickers in class.

As part of a University of Wisconsin System, Office of Learning and Information Technology, Curricular Redesign Grant, entitled Student Response Systems- Exploring Potential and Assessing Impact which involved four universities, 27 faculty members and over 3,500 students’ data was collected on how instructors used the student response systems to actively engage students and facilitate student learning. A questionnaire was developed by the Learning Technology Center at University of Wisconsin at Milwaukee and survey data were collected from students enrolled in one of four University of Wisconsin campuses, including UW- Eau Claire (n=283), UW-Oshkosh (n=467), UW-Milwaukee (n=1,519), and UW-Whitewater (n= 415). The research question is:

- H3:** Student perceptions of clicker effectiveness differ between the Tax I class of this study and Wisconsin System inter-university study cited above.

RESULTS AND ANALYSES

Hypothesis 1 & 2a, b

In order to shed light on the first three hypotheses, data collected from a tax accounting class over two semesters are subject to two separate multiple regression analyses. Specifically, the dependent variable is the number of correct answers on the set of nine multiple choice questions while the two independent variables are students’ cumulative GPA provided by the students themselves in a simple class survey and the clicker dummy variable where 0 means that a clicker is not employed when the instructor lectured the related tax accounting concept.

A positive and significant coefficient related to the GPA variable in both multiple regression equations give support to H1 (see Table 2). On the other hand, there is a positive and statistically significant relationship between use of the clickers in class and students’ subsequent exam performance on related multiple choice questions only for Question Set 1, but not for Question Set 2 (see Table 2). That is, the findings only give partial support to H2. In other words, whether using clickers in class can enhance students’ exam performance might contingent upon the underlying accounting concepts taught/discussed in class.

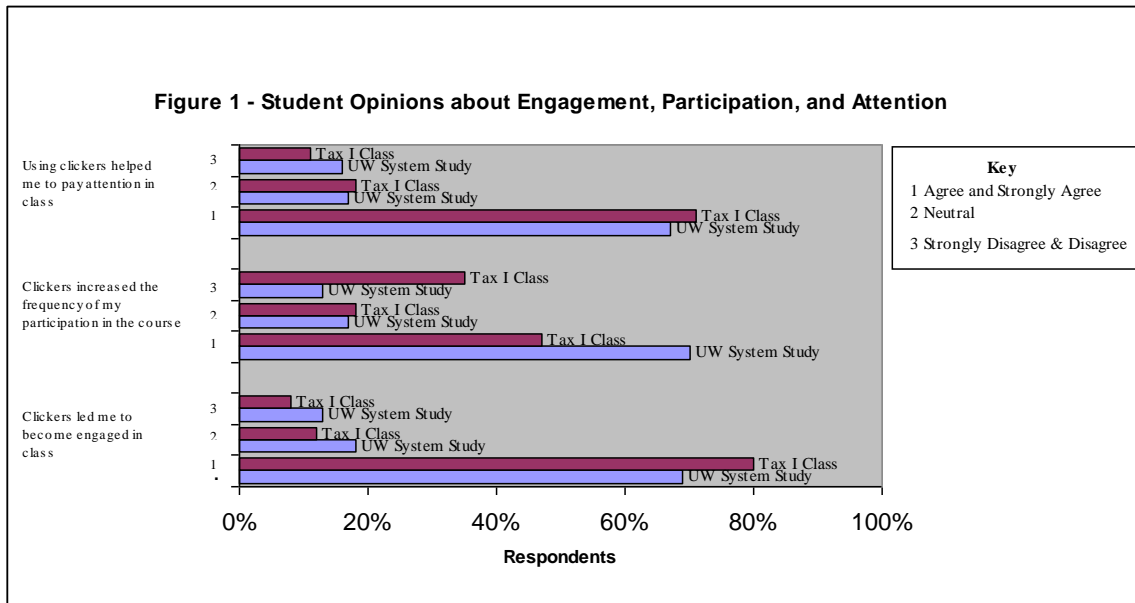
Table 2: Regression Analysis Results on Question Set 1 and Question Set 2

Hypothesis Tested	Independent Variable	Question Set 1		Question Set 2	
		β (standardized)	p-value	β (standardized)	p-value
H1	GPA	.27	.000	.30	.000
H2a, b	Clicker (dummy)	.26	.001	.03	.723
	Total R ²	.15		.09	
	F value	13.99		7.55	

Hypothesis 3

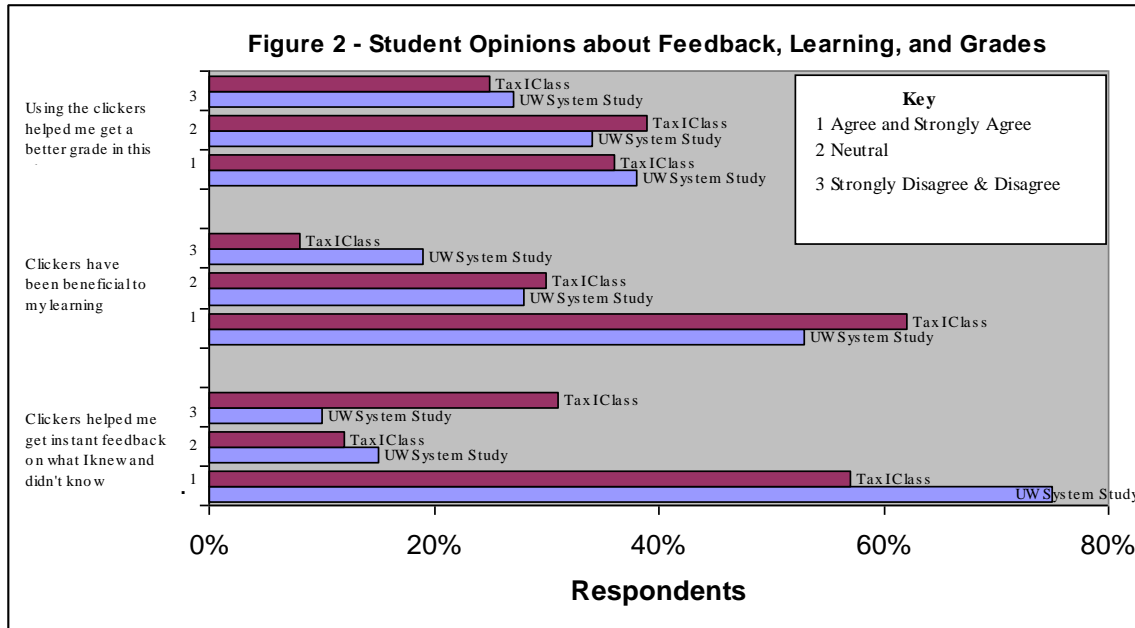
Classroom Engagement

The majority of students (See Figure 1) in Tax I classes strongly agreed or agreed that the use of clickers made them feel more engaged (80 percent) in class and helped them pay attention (71 percent) in class. Similar measures for students in the UW-System study indicated engagement at a relatively lower level (69 percent) and paying attention in class (67 percent). However, 47 percent of the students in Tax I classes agreed or strongly agreed that they increased the frequency of student participation in the course while 70 percent of the UW-System study reported an increased the frequency of participation in their course.



Student Learning

The majority of students (See Figure 2) in Tax I classes strongly agreed or agreed that clickers helped them get instant feedback (57 percent) on what they knew or didn't know and that clickers had been beneficial (62 percent) to their learning. Similar measures for UW-System study indicated feedback at 75 percent and beneficial to learning at 53 percent. Yet when students responded on whether the clickers helped them get a better grade in class only 36 percent of the Tax I class were in agreement while the UW-System study indicated 38 percent of those students were in agreement.



DISCUSSION AND CONCLUDING REMARKS

The significant and positive relationship between student exam scores and their cumulative GPA for both question set 1 and question set 2 seems to suggest that those who perform well in a traditional lecture-oriented class setting also do well in a clicker-enhanced class setting. Simply put, diligent students will continue to perform well in a learning environment where clickers are introduced into the classroom. Though the use of clickers may not always induce a better exam performance, clickers could be a useful pedagogical tool with the potential to facilitate students’ learning.

Comparison of this Tax I Class to the UW-System study found that the majority of students from both groups found that the use of clickers in class helped them to be more engaged in class, helped them to pay attention in class, was beneficial to their learning, and helped them to get instant feedback on what they knew or did not know. Yet only a little more than one-third of these students reported that clickers helped them to get a better grade in the class.

Future research needs to validate our findings in other business disciplines and perhaps in a graduate course as well. We recommend further studies to find innovative ways and means to facilitate students learning.

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