Clickers - Are They Effective as a Teaching Tool in Intermediate Accounting 2?

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Abstract

This paper compares two classes of Intermediate Accounting 2 that were taught Spring 2009 at a regional state university in the Southeastern United States. In Class One, clickers were used every class meeting and in Class Two, clickers were not used at all. Overall student performance in Class One was compared with Class Two, and each class was analyzed independently to determine relevant predictors for success, or lack of success, within the class. Predictors included are: Grade Point Average (GPA); English Comp I (ECI); Male/Female (M/F); Cumulative Participation (CP); and Age. It was determined that the use of clickers did not enhance nor diminish the performance of the students in Class One. Findings also show that only GPA was significant in predicting student success in the class, and although 2/3 of the class said that they liked using clickers, their Course evaluations were less positive for Class One than for Class Two.

Introduction and Review of Literature

In the past thirty years, information technology has become a major resource of teaching and learning in the higher education classroom. Stemming from the school of thought that "learning is not a spectator sport," technology tools in the classroom allow the student to perform and then receive feedback on their performance. In addition, it encourages students to be interactive, problem oriented and motivated (Chickering and Ehrmann, 1996; Twetten et.al., 2007). A new trend is the use of classroom response systems (CRS) which is "…any system used in a face-to-face setting to poll students and gather immediate feedback in response to questions posed by instructors" (Deal, 2007). The basics of a clicker system involve the instructor presenting the class with a series of multiple-choice or true/false questions in a PowerPoint presentation, and the student then keying their

answer into a small remote transmitter that acts as a keypad sending a signal to a receiver that is connected to the instructor's computer. Software on the instructor's computer instantly tabulates and graphs student responses that the instructor displays on the next slide. This allows the instructor to gauge student comprehension of materials so the instructor can encourage further discussion on key concepts while maintaining the student's attention. The software can also maintain cumulative data on student retention and performance as well as attendance. Further, a huge advantage of the CRSs is that the technology also acts as a student self-assessment tool that gives the student a comparison of their level of understanding compared to their peers. This timely feedback may incite motivation of the students to spend more time outside the classroom in preparation for the lecture and clicker questions (Ward, 2003; Deal, 2007; Kenwright, 2009). As Kenwright puts it, "Sometimes students think no one else in the class understands, so it must be the professor's fault. When they see that 80% of the class answered the question correctly, but they did not, it is motivation to study more" (2009, p. 74).

Many college campuses are utilizing clicker technology in their classrooms. In a 2007 study of three large universities (University of Pittsburgh, University of Maryland, and University of Delaware), clicker usage on a regular basis was found in both large and small classes and was found to be used most often in science and business courses (Arenth, Higgins, and O'Laughlin, 2008). Furthermore, several studies have shown that utilizing CRSs in college classrooms increases attendance, especially when clicker quiz scores are utilized in grade calculation, interaction and camaraderie. With the anonymity of their responses, students develop the courage to participate, which leads to greater student enjoyment and an increase in active participation in class activities (Stowell and Nelson, 2007; Nelson and Hauck, 2008; Kenwright, 2009).

Accounting curricula has been challenged to reconsider present practices since the Bedford Report (AAA, 1986), the Big 8 White Paper (Andersen, et.al., 1989) and most recently, the business scandals which sparked the Sarbanes-Oxley regulation legislation and changed the role of the American Institute of Certified Public Accountants in all areas of training. Accounting instructors in post-secondary institutions have been challenged to motivate students to not only comprehend the information and apply the knowledge from the textbook to classroom problems, but also to develop intellectual skills "…to use creative problem-solving skills in a consultative process…to solve diverse and unstructured problems in unfamiliar settings…to comprehend an unfocused set of facts; identify, and, if possible, anticipate problems; and find acceptable solutions" (Arthur

Andersen, et.al, 1989, p. 6). Also the American Accounting Association (AAA) states that "…the primary classroom objective should be to emphasize students' learning…while improving the student's communication and team skills as well as their understanding and utilization of information technology" (AAA, 1998). As such, many studies have focused on whether accounting text materials improve cognitive skills that lead to positive results through testing and whether there is a positive association between providing check figures and solutions in order to motivate students and improve test scores (Davidson and Baldwin, 2005; Lindquist and Olsen, 2007). From the homework perspective, Rayburn and Rayburn (1999) found that there is a positive correlation between homework completion and student performance in an introductory accounting course. Their research was replicated by Peters, Kethley, and Bullington (2002) for an introductory operations management course and found that requiring graded homework had a negative effect on exam performance. Thus, it might be characterized that some courses, like accounting, are a "learning by doing" course whereas others involve more conceptual learning.

Other studies have focused on the usage of technology by accounting faculty in either in-class or outside-the-classroom activities and found that over 60 percent of faculty utilize technology regularly in the form of computer projected lectures, email, internet search engines used for research, and receipt of work assignments in an electronic format. On the flip side, less than ten percent have enabled and supported collaboration among students via web-based programs, virtual environments, on-line bulletin boards or chat rooms, and web-based tests or quizzes (Roberts, Kelley, and Medlin, 2007).

Few studies have been conducted on the introduction and usage of CRSs in the classroom. Carnaghan and Webb (2007) is the only study found by the authors. Carnaghan and Webb's study group included four sections of introductory management accounting courses with approximately 200 students as the treatment groups. They used student surveys to evaluate student satisfaction with the CRS as well as performance measures on the midterm exam and oral participation by the students over the course of the term. The results indicated that while students receive satisfaction with the usage of technology in the classroom and learning on their own, the examination results were only positive when like questions were used in the classroom and covered on the examination. One of their study constraints is that the results were based on one or two questions per topic, per exam, thus Carnaghan and Webb state that further research is needed to examine whether the level of material difficulty has a negative or positive correlation on the relationship between exam performance and CRS usage in the

classroom. As intermediate accounting is considered to be one of the more difficult and demanding junior-level accounting courses, this study will serve to further the research started by Carnaghan and Webb. This study will be useful to accounting pedagogy literature as well as possibly being considered by other challenging course subjects on whether a CRS is beneficial to the classroom environment.

Method
Overview of Classes

The Intermediate 2 classes selected for this study have the following characteristics: Class One, the "Clicker" class, taught on a MWF basis from 10-10:50 am. Class Two, the traditional, or non-clicker class, taught MW nights from 7:30 to 8:45 pm. The same chapters were taught in each class, and the same chapters were on each exam; however, since the testing period for Class One was only 50 minutes, the tests covered two class periods. The first section of the test consisted of Multiple Choice questions, and the second was made up of problems in which the students had to demonstrate their work in solving problems. Grades for the two parts were combined to represent Exam I, II, and III. The tests for Class Two were also made up of these two sections, but the sections were combined into one testing instrument. Test 4-A was administered as an online, timed test for both classes and represented the multiple-choice section of the test. Test 4-B was given in class and consisted entirely of problems where students had to write their solutions by showing and labeling their work.

Common to Both Classes

The textbook used in both classes was Intermediate Accounting, 12th edition, published by Wiley and written by Kieso, Weygandt, and Warfield (2007). The same chapters were covered in both classes. Other than the use of clickers in Class One, all other class policies, as well as the point-count for exams and assignments, were the same.

Another thing that both classes had in common is that the instructor called for written, student feedback at the end of the class coverage of each chapter. This feedback was to include the one most difficult concept in the chapter for which the student needed a bit more practice or discussion. If a student had no need for additional help, they would simply write the chapter number and "OK" on their paper and turn it in. Feedback from the students was anonymous.

Class Two

Class Two (Course Syllabus provided upon request) was taught in a traditional manner where the instructor takes roll each class, lectures on each chapter and works numerous exercises and problems from the end-of-chapter materials in the textbook. The students' Class Participation (CP) grade was derived from voluntary, oral responses in class from students to questions asked by the instructor. In order to earn credit, the student's response must be correct. They had to raise their hand and be recognized by the instructor before answering, and a "first come, first served" process was followed. Students were thanked for trying and encouraged to try again if their answer was incorrect, but awarded 5 points if their answer was correct. Students were limited to 5 points for a class session and 80 points for the term.

Class One

As noted in the Course Syllabus for Class One (copy provided upon request) students were told that attendance would be taken via their clicker responses to questions in class. If they did not bring their clicker to class, they would be considered absent, and thus would receive no credit for questions that day. It was originally thought that this might be an issue with some students and lead to complaints, but that did not turn out to be the case. As a matter of fact, about mid-way through the semester, the students were joking with each other about a day here or there when one of them forgot to bring their clicker. Of course that was the day when they would have known all of the right answers!

Registering clickers to students. In order to capture the daily data for each student, it was necessary for each of them to register their clicker under their name. To accomplish this, the instructor entered the class roll into a file folder provided in the clicker software and notified the class that there would be an electronic roll call at the first of the following class meeting. Before the electronic roll call, the students were told to have their clickers turned on and be ready to respond when they spotted their name scrolling down the projector screen. Their clicker response would be the letter or letters beside their name. For example one student may just need to enter "A," whereas another student may need to enter more than one letter, such as "A, B, D." The instructor determined the speed of the scrolling process, and since this was the first time this system had been used by the instructor and the students, a slow speed was selected. The roll call process was completed the next class meeting due to one absent student, and for the remainder of the semester, all of the clicker responses to clicker questions were captured, and only those students who did not respond to clicker questions were counted absent.

Before relying on the data capture system, the instructor wanted to make sure that all of the students were registered and that their responses were being captured accurately. This was accomplished the first day the clickers were officially used in class. The students were instructed to write their name on a sheet of paper, write the question numbers along with their responses to each clicker question and turn in their paper. The instructor verified that the proper clicker was registered to each student and that the proper responses were captured to that clicker. It was found that the process had worked just as it should, and all of the students were properly registered.

Operating the clicker system. Although there are a number of ways to set up clicker questions, the instructor chose to insert multiple-choice questions into the PowerPoint presentations that were provided by the publishing company. This was done for each Learning Objective in each chapter. Care was taken in choosing clicker questions that were similar in content to the exercises that were worked in Class Two.

Student responses to clicker questions were accumulated via the software included with the clicker system and totaled chapter-by-chapter to comprise the Class Participation component of the students' grade. The instructor would show a clicker question, start the timer that is visible to the class, and give the class a 10-second warning before ending the availability of the question. This 10-second warning gave students an opportunity to enter their answer before the time expired. Due to the fact that some questions required computations and others did not, there was no pre-determined timeframe for all questions. The instructor made a judgment call as to how much time to allow for each question—another reason for using the 10-second warning.

Immediately following the expiration of time, the results of the class responses were shown—in a graph with the total number of responses for each possible answer. A discussion usually followed, and finally, the correct answer was shown. Initially, there was an occasional student who appeared to cheat by entering the same answer as they saw the student to their right or left enter, but the instructor cautioned against this and watched them closely while they worked. After that, most students worked independently.

In order to encourage students to do their best to answer questions correctly, they earned 1 point for correct responses; however, they could also earn ¼ point even if they entered an incorrect response. They really liked this feature, because they at least got some credit for being present and trying to get the answer right.

Clicker Pros and Cons

The time commitment from the instructor for conducting Class One was significantly more than for Class Two. There was a steep learning curve initially that was compounded by the fact that no other faculty at the college had previously used the system, so solutions to implementation problems required reading the Instruction Manual or talking to Customer Service for that particular clicker company (iClicker). It is noted that if the class were taught in a subsequent semester using the same textbook, the time factor would not be as much of an issue.

The reporting system provided by the clicker software was comprehensive. Regarding taking roll via the student's use of the clickers, yes, this did take some of the instructor's time outside of class, but when the clicker response report was printed, it was easy to determine who was absent on a given day.

Although it was not necessary to print every report that was made available via the clicker software, the reports that were printed consumed a much larger quantity of paper than was needed for the non-clicker class. It may be true that once an instructor becomes more familiar with the information in the clicker system, electronic files could be used more and printed copies less.

Results

The purpose of the study was to determine whether the use of clickers improved student performance, and more specifically, in a class that is generally considered more difficult than introductory accounting classes. In order to isolate the effects of the clickers, variables commonly believed to relate to student performance were also collected. The cumulative GPA, English Composition I grade, Age, Class Participation, and Gender were collected for each student.   These variables were selected based on convenience and logical, potential correlation to student performance. Additionally, student feedback from Class One was collected during the semester, and teaching evaluation scores for both classes were collected at the end of the semester.

There were 31 students in the Class One, the clicker class, and 15 students in Class Two, the non-clicker class. Three students were dropped from the study because they did not complete the class, and two additional students were dropped because they were transfer students and their records did not include English Composition I or prior GPAs. The final sample consisted of 28 students in Class One and 13 students in Class Two. There were 27 females and 14 males in the study. There were 14 students 22 years

of age or younger, 19 students between 23 and 30 years of age and 8 students older than 30. The mean GPA was 2.96 on a four-point scale (Table 1).

Table 1 – Student Descriptive Information

Category	Class One	Class Two	Total
Males	9	5	14
Females	19	8	27
18-22	9	5	14
23-30	14	5	19
>30	5	3	8
Average English Comp 1	3.21	2.85	3.10
GPA	2.99	2.91	2.96
CP	63.11	64.38	63.51

The data was analyzed using analysis of variance statistical methods. The exam scores (Exam I, II, III, 4-A and 4-B) were dependent variables and Class, Gender, Age, English Comp I were independent variables with Class Participation, and GPA as covariates. Class Participation was not a significant covariate on any of the exams. GPA was a significant covariate at $p < .05$ for Exam I, III, and 4-A. After controlling for the effect of GPA, Class had a significant effect only on Exam 4-A, $F(1,19) = 15.09$, $p < .05$. Further, the mean difference on Exam 4-A was 19.63 higher in Class Two compared to Class One, with a SD of 4.46, $p < .05$. So, as expected based on common knowledge in the academic environment, the students' prior GPA correlated to class performance; however, the use of clickers was not a significant factor in four of the five exams. Therefore, the conclusion is that the use of clickers did not significantly influence student performance.

About ¾ of the way into the semester, students participating in Class One were asked to anonymously comment on their perceptions about using clickers in this class. There were 15 positive comments and eight negative comments from the students, indicating that about 65% of the students liked the experience, while about 35% dislike the experience. Table 2 is a sampling of the students' comments.

Table 2 – Sample of Student Comments About Clickers

Positive student comments
It allows everyone the opportunity to answer the same question, allowing for more feedback and allowing everyone to receive credit for the same question.
The clicker gives students a chance to participate in discussion without being embarrassed if they get the question wrong or worried about getting it wrong.
If you get the question wrong or right it opens the floor for more discussion on that topic.
I liked using them because I don't like answering out in class even if I know the answer. This way, for shy people, participation points are earned.
I think the clicker system is a great idea because no matter how busy a student is, they would probably try a lot harder to make it to class in order to get participation points through the system. It's a great way of learning in addition to keeping attendance up.
I like it because knowing that we have clicker questions everyday it actually makes me want to read the chapter.
I thought it was a little more stressful since you never knew when there were points on offer. It did make you at least read the work beforehand.
Negative Comments
I believe the clicker system takes away from student interaction in class. I like the old way of getting participation points.
I think that it forces student to learn at a faster pace. It doesn't give students the chance to learn at their own pace. When only having a certain amount of time to work a problem.
With the clicker you don't have enough time to work out the problem in order to be able to answer the question.
The clickers are a good way to have everyone participate in general. I don't like how much they weigh on our grade. There's no chance for error when doing them.
The clickers make you study each day, and some people can't study at that pace. Some people have jobs. I learn better by studying at my own pace.
I personally don't like it because we don't have access to the question for studying. I prefer going over book problems in class.
It put too much pressure on student to get the right answer. I don't like them.

Faculty student evaluations were conducted at the end of the semester. The university requires anonymous student evaluations in every class every semester. The evaluation process changed from a paper-based format to an online format the semester this study was completed, so this

may have resulted in a lower response rate than the previous method, but it is deemed adequate for this study. In Class One, 23 students (74%) completed the evaluation, and ten students (66%) from Class Two completed the faculty evaluation. Table 3 summarizes the questions that the researchers thought most closely related to the study.

Table 3 - Selected Questions From Students' Evaluations

Question from Student Evaluation of Faculty Member	Class One Average	Class Two Average
The instructor encourages questions.	3.36	4.30
The instructor promotes a class environment conducive to learning.	3.64	3.70
I have progressed in my ability to think critically, to solve problems, and/or to make decisions.	3.09	3.70
The course materials were easily accessible and user-friendly.	3.27	4.50
The technology in the classroom (virtual or real) aided learning.	3.73	4.20

The student evaluation form is a likert scale anchored with 5: strongly agree and 1: strongly disagree. Class Two students rated the faculty member higher on every question than the students in Class One.

Discussion

Student Performance and Perceptions

Consistent with Carnaghan and Webb (2007), student performance did not improve with the use of clickers. Students had positive comments about the immediate feedback, opportunity for self-assessment, and ability to participate without embarrassment. Although these are all positive comments, student performance did not improve.

Other student comments refer to increased motivation to read the material and to be prepared to participate in class. The assumption would be that this would improve grades, but in fact, the Exam 4-A grades were lower in Class One than Class Two by more than a letter grade on average. This was true even though the overall GPA was comparable between the classes.

Additionally, cumulative participation was not significant even though students commented about being less shy to participate. The results

seem comparable to the Peters, Kethley, and Bullington (2002) findings that requiring graded homework had a negative effect on exam performance. Both classes required Class Participation, but using the clickers did not result in significant, positive effects on participation. Perhaps the student comments about "learning at their own pace" and "lack of time to work the problems" were overriding considerations.

Student Evaluation of Faculty

Student comments seem to imply that they enjoyed the class more with clickers. The researchers thought this might lead to higher teaching evaluations, but this was not the case. The teaching evaluation scores were lower in Class One than in Class Two. The sample was small, and this may have affected the results. However, the power for those statistics reported were .9 or above.

Future research should consider using a larger sample and may consider rotating the use of clickers between groups perhaps before midterm and after. This might decrease any bias due to groups, time of day, or length of class.

Conclusions

This study expanded on the Carnaghan and Webb (2007) study by using Intermediate Accounting 2, a class commonly considered to be more challenging than Introductory Managerial Accounting. Additionally, this study included more performance measures than the previous study. The results of this study indicate that performance did not improve. Students had positive comments about the use of clickers, but these were not reflective in the student evaluations of faculty. As noted earlier, adopting and implementing the technology is very time-consuming for the faculty member, but the time required should decrease with subsequent offerings using the technology. The benefit of using this technology appears to be students' enjoyment—not student performance nor improved faculty evaluations.

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