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Empirical Evidence Regarding the Relationship between the Computerized Classroom and Student Performance in Introductory Accounting

Anna L. Lusher
Slippery Rock University

Marsha M. Huber
Youngstown State University

Jesus M. Valencia
Slippery Rock University

Abstract

Given the increasing use of technology in the classroom, both here and abroad, this paper addresses how the use of technology in the classroom affects student performance. We address this issue by reporting results from a quasi-experiment where student learning is compared in two different classroom settings—a traditional "pen and paper" classroom[1] and a completely "computerized" classroom[2]. Students in the "pen and paper" classroom (control group) used "pen and paper" for classroom activities (in-class assignments, a group project, and in-class exams) and only had access to computers outside the classroom to complete homework assignments; whereas, students in the "computerized" classroom (treatment group) used the computer for all activities during each classroom meeting. Mean scores on all activities (in-class assignments, a group project, homework assignments, and in-class exams) for both groups were compared (co-varied for GPA) to measure the relationship between the learning environment (pen-and-paper vs. computerized) and student performance in an introductory financial accounting class. We found that students in the computerized classroom scored significantly higher on homework and tests, but not on in-class assignments or the group project. We attribute these varied results to the enhanced active learning environment due to the computerized setting. These findings can be used to help accounting programs assess which types of assignments are enhanced by technology.

Introduction

Accounting graduates must be competent in their use of technology. In a report about the state of accounting education in the mid-1980s, the Bedford Committee warned, "A growing gap exists between what accountants do and what accounting educators teach" (American Accounting Association [AAA], 1986, p. 172). Thus, the

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[1] The *"pen and paper"* classroom contained one computer and a projector and screen for the instructor's use to facilitate the learning process. This setting is commonly referred to as a "smart" classroom. Students use "pen-and-paper" to complete assignments in class. Therefore, the classroom is referred to as the "pen and paper" classroom in this article.

[2] A *computerized* classroom is equipped with computers for both instructor and student use.

academic community has been challenged to provide students with the knowledge, skills, and values needed for success in the accounting profession.

The accounting profession recommends that computers be used in the classroom to improve student learning and to prepare students for accounting careers (AAA, 1986; Big Eight Accounting Firms, 1989). Deloitte (2011, p. 29) states in its article on the "top ten" issues facing higher education, "Institutions must leverage technological innovations to better engage and serve students." The AICPA *Core Competency Framework* describes leveraging technology as identifying technology-related risks, accessing databases, and using spreadsheets and software effectively (Bolt-Lee & Foster, 2003). With this being the digital age, modern-day accounting professionals are expected to be both competent and comfortable with the use of technology.

Accounting education has made progressive strides in accomplishing this goal. In the late 1990s, studies indicated that most accounting courses had been taught using the same methods that were used over the past half-century (Big Eight Accounting Firms 1989; Albrecht & Sack, 2000; AAA, 1986; Accounting Education Change Commission [AECC], 1996). In the last decade, however, the use of technology in accounting programs has increased at a rapid pace (Apostolou, et al., 2010). As a result, researchers have examined how technology impacts student learning (Edmonds & Edmonds, 2008; Benware & Deci, 1984). Prior studies have tested the benefits of using software applications and specialized technologies such as clickers in the classroom (Carnaghan, Edmonds, Lechner, & Olds, 2012). Results, although mixed, have been mostly positive (Haverty, 2012; Abdel-Azim, 2006; Homik & Thomburg, 2010; Bonwell & Eison, 1991; Felder et al., 1998; Berg et al., 1995; Potter & Johnston, 2006).

For this study, the researchers polled accounting chairpersons to ask them about their concerns with technology use in the classroom so to better frame this paper to address legitimate concerns.[3] The survey revealed that although computer-use mirrors the "real world," [4] chairpersons felt that technology promoted rote learning, not critical thinking. Chairpersons also felt that using templates gave students too much structure, thereby precluding students from truly learning the concepts behind problem-solving. In addition, the researchers also wanted to know if chairpersons were interested in learning more about "the effects of the computerized classroom on student learning." When asked this question, the majority of accounting chairpersons (65%) responded "Yes."

Thus to extend the literature on technology use in the classroom, this study provides insight into how students use technology to learn accounting today. It's not just whether computer-based learning is appropriate in introductory accounting, but also the CONTEXT in which the computer is used to facilitate the learning process. That is, it may be appropriate for some tasks/assignments, but less suitable for others. By comparing student achievement in two different classroom environments—a traditional "pen-and-paper" classroom (control group) to a completely "computerized" classroom (treatment group)—this study provides preliminary evidence regarding this contextual issue.

The remainder of this paper is organized into four sections. First, we examine the literature on the effective use of technology in the classroom. On the basis of this literature review, we develop a set of testable hypotheses. Second, we detail the procedures used to gather the data and discuss measurement choices. Third, we present quantitative and qualitative analyses of the effect of educational environment (computer versus pen-and-paper) on student performance in introductory accounting. Finally, we discuss limitations of the present research effort, implications of our results, and give suggestions for future research.

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[3] In May 2012, a survey, the Chairperson Technology Survey (CTS) was mailed to 892 accounting chairpersons (see Appendix 1). 183 chairpersons (20% response rate) completed the online survey. Demographics and a brief summary of results for the CTS are included in Appendix 2.

[4] 67% of chairpersons (85 of 127 who responded) believe the primary benefit of using technology in the classroom is that it mirrors the "real world" and prepares students for their future work environments.

Literature Review and Hypotheses Development

Using technology in the classroom promotes both active learning and academic achievement (Edmonds & Edmonds, 2008; Benware & Deci, 1984). Beginning in the late 1980s, accounting professionals began recommending the use of technology as an alternative teaching technique (Big Eight Accounting Firms, 1989). Basile and D'Aquila (2002) found that students that used technology in classes were more engaged in the learning process. For example, students in an auditing class that used an auditing software package reported enhanced understanding of statistical procedures (Richardson & Louwers, 2010). Students that used a variable sampling software package scored significantly higher on assignments than those who did not (Anderson et al. 1988). In a graduate-level intermediate accounting course, students using a computer program to classify capital and operating leases, made significantly fewer errors on lease assignments than students using the textbook alone (Böer & Livnat, 1990).

The use of spreadsheets is an especially effective pedagogical tool. When students used spreadsheets to account for pensions, they scored significantly higher on tests than those who did not use them (Kachelmeier, et al., 1992). The use of templates to solve homework problems in managerial accounting showed significant improvement in student performance over those who did not (Oglesbee et al., 1988). When students in a cost accounting class designed a spreadsheet program to solve problems, there was a significant increase in student grades for the experimental group (Elikai & Marts, 2000).

Several recent studies have looked at the effectiveness of on-line homework management systems (OHMS). Haverty (2012) stated that eight of eleven studies that tested student reactions to OHMS reported positive reactions, with three studies reporting no effect. Dilliard-Eggars, Woten, Childs, and Coker (2008) found that students that used OHMS spent more time studying the course material, thereby resulting in higher final grades. Another study found that final exam grades were higher after the adoption of OHMS than before its adoption (Collins, Deck, & McCrickard, 2008). Phillips and Johnson (2011) extended the research on OHMS to find that students experiencing intelligent tutoring systems performed better than students using traditional OHMS.

The United Arab Emirates (UAE) University conducted a comprehensive study on the digital age. In 2001, the UAE College of Business and Economics began transforming its accounting program into an active learning environment by integrating technology and OHMS into its learning processes (Abdel-Azim, 2006). Students used laptops inside and outside the classroom to access course materials and to complete coursework that included quizzes, exams, in-class assignments, and case studies. By 2005, students experienced significant improvements in their performance and reported higher satisfaction levels on student evaluations.

Gaming is also popular with today's college students. Gamers are estimated to have played 10,000 hours by the time they graduate college (Selverston, 2012). A study by Hornik and Thornburg (2010) used a gaming environment to teach introductory accounting. They used the *Second Life* platform with a 3-D virtual learning world in an introductory financial accounting course. Students who were actively engaged in the program experienced improved performance and increased time-on-task.

Researchers have also investigated the effectiveness of on-line collaboration in an accounting education context. A university in Taiwan set up a "Cyber University" where students performed the following activities on-line: attended functions, met with professors and other students, and discussed accounting issues and assignments (Cheng, 2009). In regards to problem-solving attitudes, students reported improved confidence and self-regulation in the web-based collaborative environment over the traditional environment. This study, however, did not report on student performance.

Not all research, however, has found that technology leads to improved student performance. One early study by Dickens and Harper (1986) found no significant difference in performance when students used menu-driven software packages to calculate earnings per share and tax allocations in an intermediate accounting class. Carnaghan and Webb (2007) found that the use of group response systems (GRS), also known as clickers, in a management accounting course did lead to greater student satisfaction, but not improved student learning (Carnaghan, Edmonds, Lechner, & Olds, 2012). In fact, students were less inclined to participate in class discussions if the GRS feedback showed the majority of students understood the concepts under review. Finally, one study using a quasi-experimental design had quizzical findings, unexplained by the authors. Researchers found that the OHMS did not enhance exam scores, but did enhance scores on written ethics cases and a comprehensive accounting problem (Gaffney, Ryan, & Wurst, 2010).

The difference between success and failure may hinge on the levels of student engagement in active learning. Active learners are more motivated and score higher on assignments and exams (Bonwell & Eison, 1991; Felder et al., 1998; Berg et al., 1995; Potter & Johnston, 2006). In the studies where students were involved in problem solving, spreadsheet analysis, and simulations, they learned better and benefitted more from the active learning environment. This might have occurred because of what Svinicki (2012) identifies as benefits of active learning:

1. Students are more likely to access their own prior knowledge, which is a key to learning.
2. Students are more likely to find personally meaningful problem solutions or interpretations.
3. Students receive more immediate feedback.
4. The need to produce forces learners to retrieve information from memory rather than simply recognizing a correct statement.
5. Students increase their self-confidence and self-reliance.
6. For most learners, it is more motivating to be active than passive.

If technological innovations simply require students to act as passive learners (i.e. putting numbers in a formula or using clickers); they will not glean the same benefits as technological innovations that call for active learning (i.e. creating spreadsheets or playing simulations). Or possibly, if students are not engaged in using the OHMS, improved learning will not result. As Apostolou suggests, these differences might be caused by whether "students are using technology to learn about accounting or just using the technology to satisfy course requirements (Apostolou, et al., 2010, p. 183)."

The theory of "situated learning" offers an alternative explanation as to why certain technological innovations may succeed or fail. Situated learning suggests that learning results from the transactional relationship between learners and their educational settings – referring to atmosphere, ambience, tone, and/or climate. In fact, research has shown that the quality of the classroom environment is a significant determinant of student learning (Fraser, 1994, 1998; Dorman, Fisher, & Waldrip, 2012).

Lave and Wenger (2006) state that learning takes place in a participatory framework, not in the individual mind. In the past, educational theorists viewed the learner as active and the learning environment as passive. With the advent of computerized classrooms, practice theory recognizes that the learner and the learning environment can act as co-participants in the learning process (Lippman, 2010; Dent-Read, & Zukow-Goldring, 1997). Lippman asks, "How does the learning environment shape the learner, and in turn, how does the learner influence the learning environment (2010, p. 1)?"

An important accounting educational issue to consider is the context in which learning occurs. In certain learning contexts, such as the traditional classroom, students may disengage before acquiring mastery over core skills (Lave & Wenger, 2006). If the computerized setting acts as a co-participant in the learning process, then students will remain engaged longer in the learning process and learn more than in a traditional classroom. In fact, Hanks (Lave & Wenger, 2006) criticizes instructional settings that separate learners from the "real world" setting. He believed students should learn their disciplines in an environment as close to the "real world" as possible.

This study also examines the issue of student performance. For most of the studies cited in this literature review, examination questions were the most commonly used measure of academic achievement (Davidson, 2002; Carnaghan & Webb, 2007; Jones & Wright, 2010). As a result, this study will use exams as one indicator of student learning. Based on prior research, the first hypothesis to be tested is:

H_1: After adjusting for preexisting differences in cumulative GPA, students in the computerized setting (treatment group) will, on average, have higher in-class examinations scores than students in the traditional "pen and paper" classroom setting (control group).

In addition, chairpersons expressed concern that student learning needs to go beyond "rote memorization" for exams and include other types of learning such as analytical and conceptual thinking.[5] Thus this study will examine the relationship between the computerized classroom on student performance on homework problems, the out-of-class small-group project, and the in-class exercises. These types of learning have been correlated to higher grades (Davidson, 2002; Gow et al., 1994). The second set of hypotheses, therefore, consists of three sub-hypotheses, each pertaining to each type of assignment:

H_2: After controlling for pre-existing differences in cumulative GPA, students in the computerized setting (treatment group), compared to student in the "pen and paper" classroom setting (control group):
a) Will have higher scores on their individual in-class assignments;
b) Will have higher scores on their homework assignments; and
c) Will have higher scores on their final project.

The researchers expect higher examination scores for **H_1** for the treatment group because of prior studies (Bonwell & Eison, 1991; Felder et al., 1998; Berg et al., 1995; Potter & Johnston, 2006). However, **H_2** is more difficult to predict because of the lack of literature regarding computer use and other types of learning (Apostolou, et al., 2010).

Research Method

The researchers selected the first financial accounting class for this study.[6] The same instructor taught both the control and treatment groups. The control group was taught without the use of computers and consisted of 35 students; the treatment group was taught in the computerized classroom and consisted of 37 students. The statistical software *Stata* computed minimum sample sizes of n=24 were needed to test our null hypothesis with a typical 95% degree of confidence.[7]

Setting

This study took place at the School of Business at a mid-size, comprehensive, masters' level state university in Pennsylvania with ACBSP accreditation. The School of Business renovated a "pen and paper" classroom into a "computerized" learning center. Since each student had access to computer in the class, accounting instructors could integrate computer applications into the coursework. The instructor's workstation housed a computer and a document camera that captured and projected documents and other images onto a screen. Two projectors, two screens, and a printer were also available to aid in the presentation of course material.

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[5] These are responses to the CTS.

[6] There are pedagogical reasons for selecting the introductory classes for this study. First, educators believe active learning belongs in the early part of the curriculum. A questioning spirit and a desire for life-long learning should be introduced early and nurtured over time (Francis, et al., 1995; Rama, 1998). The AECC (1992) adds that students need to develop skills and aptitudes needed for success in accounting careers in introductory accounting courses. Early exposure to software programs (i.e. Excel) helps students to develop their technological competencies (AICPA, 2000). Finally, the first accounting class is important in the sustainability of the accounting major (Paolillo & Estes, 1982; Cohen & Hanno, 1993; Saudagaran, 1996). Many students make their career choice during their sophomore year when they take introductory classes in various disciplines (Nelson et al., 2008). If students enjoy learning in their first accounting class, they are more likely to become accounting majors.

[7] Results showed that the statistical power of testing for a difference in means when using the sample sizes we used was 0.9933. *Stata* estimated that sample sizes of n=24 in both groups were adequate to obtain a 95% level of confidence.

A monitoring software program was installed on the instructor's computer that gave control over student computer activity in the classroom. Thumbnail views of each student's computer could be accessed and monitored as needed. The instructor could also shut down the computers and limit access to specific programs and the Internet. When students realized that the instructor could monitor their computers, they quickly conformed to the policy restricting computer use only to coursework during class time.

Design

Both classes used the same instructor, textbook, course material, assignments, and course content. An implementer effect can occur if different instructors are assigned to implement different teaching methods (Ary, Jacobs, & Razavieh, 1996; Fraenkel & Wallen, 2009). In order to improve internal validity, the same instructor taught both the treatment and control groups.

The instructor administered 4 in-class exams in each class.[8] Students also completed 11 homework assignments (top 10 scores were recorded), 11 in-class problems on an individual basis (top 10 scores were recorded), and an out-of-class small-group project. A web-based course management tool provided Power Point slides, videos, practice quizzes, electronic spreadsheets, and other documents for both courses. Both classes also used an OHMS for homework assignments. The instructor used the same criteria to grade exams and assignments in both the control and treatment groups. Course content and coursework in the treatment group paralleled that of the control group. In-class assignments (similar in nature to "quizzes") and each of the four in-class exams consisted of questions and problems to test conceptual understanding and application of knowledge with an emphasis on analytical thinking and problem-solving. For the exams, the instructor selected a mixture of qualitative and quantitative questions/problems from the textbook's end-of-chapter material and/or test banks ranging from "easy" to "difficult."

The instructor took measures to curtail cheating. To minimize the risk of the earlier group sharing assignments and solutions with the latter group, the instructor created exams and assignments using a computerized test bank. The test bank's algorithmic feature permits comparability of assignments between groups because the concepts, format, and structure of questions and problems remained the same. The numbers in each problem were different, so the answers would not be the same. For questions that did not require mathematical calculations, the instructor matched the content and difficulty level of the assignments. To control for the possibility of assignment sharing between course sections on the group projects, the instructor randomly assigned students to groups and used different companies for each of the groups in both classes.

Treatment Group

In the computerized classroom (treatment group), students learned concepts, principles, and related procedures through practical application in an environment that simulated the workplace. As the instructor explained and demonstrated various accounting principles, students simultaneously completed templates for these topics. For coverage of topics early in the course, students used spreadsheet templates that simulated how business events were recorded and subsequently reported on the financial statements. As the instructor presented new topics, students continued to use spreadsheets to calculate and record asset depreciation and book value, amortization of bond discounts and premiums, calculate interest for notes payable and notes receivable, and calculate inventory costs. Students also completed exams, homework, group projects, and in-class assignments on the computer. Although the OHMS automatically graded the assignments, the instructor reviewed the scores assigned by the program.

Control Group

The instructor covered the same topics and concepts in the traditional "pen and paper" classroom (control group). When she taught how transactions affect balance sheet and income statement accounts on the computer, the demonstration was projected on a screen. The group completed all learning activities, including in-class projects and exams, using "pen and paper" and calculators. The control group also completed and submitted homework through the OHMS. Students in the "pen and paper" classroom, however, only had access to computers, resources and study aids, outside of class.

[8] Exams 1 – 3 were non-cumulative and Exam 4 was cumulative.

Measures

Demographic information (gender, major, class rank, and GPA) was collected through the enrollment process to examine homogeneity across groups and were treated as baseline covariate information.[9] To measure the effect of the computerized classroom on student learning, the researchers considered the following outcomes: scores on four in-class exams, scores on other assignments –homework assignments, in-class assignments (quizzes), and the out-of-class group project –and the total point score. Total points ("Totalpts") consisted of a summed composite of scores on in-class exams and all of the other assignments.

For qualitative perceptions and consideration of instructor bias, researchers asked students in the treatment group to complete an online survey providing anonymous feedback about their perceptions of learning in a computerized environment. Researchers also examined if there were any differences in how the students perceived the instructor (perhaps suggesting instructor bias) on the university student evaluations.

Data Analysis

Descriptive information was examined, and t-tests (for GPA) and chi square (for gender, major, and class rank) tested baseline differences across groups. Group differences were then examined through two processes. A repeated measures ANOVA was used to investigate group differences across the four exams, controlling for baseline covariates. Possible interactive effects between gender and group, GPA, and class rank were included. In addition, ANCOVA tested group differences in points, controlling for baseline covariates. The advantage of ANCOVA over ANOVA is that the inclusion of the covariate reduces variance when testing the null hypothesis and thus increases the power of the test.

The Assumptions Imposed by ANCOVA

ANCOVA is a parametric estimating technique, and it requires that observations gathered in both groups belong to variables that are independently and identically distributed. More precisely, ANCOVA requires that observations in the control group (and experimental group) belong to independent normally distributed random variables. The F distribution is used to test for significance depends on the assumption of normality of scores in both groups. Statistical tests were carried out to test for normality in the distribution of the variable "Totalpts" in both groups. Our tests showed that both groups had a normal distribution.[10]

Results

Descriptive Statistics and Baseline Differences

Descriptive information is summarized in Table 1. Seventy-two students participated in this study conducted in two sections of an introductory accounting course (control = 35 students; treatment = 37 students). Males represented 69% of the class in control group and 59% of the class in the treatment. The control group consisted of 5 seniors, 9 juniors, 13 sophomores, and 8 freshmen. The treatment group consisted of 4 juniors, 16 sophomores, and 17 freshmen. Students in both groups were mostly accounting and other business majors, but non-business majors were also represented.

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[9] Many variables can also affect the success or failure of a student in the classroom. This includes the quality of the instruction and the effort put forth by students. Some studies have also shown positive correlations between gender, class rank, major, and GPA on student performance (Bouillon, Doran & Smith, 1990; Danko, Duke, & Franz, 1992; Norton & Reding, 1992). Other studies indicated no significant effect. These variables were added to this study also as control variables in the testing of the research hypotheses.

[10] Testing for normality required testing for skewness and kurtosis. Results showed that the null hypothesis of a normally distributed "Totalpts" variable could not be rejected with about a 90% level of confidence for the control group. The results for "Totalpts" were the same for the treatment group, but with a 94% level of confidence.

The average GPA for the control group in the "pen and paper" classroom was 2.78 (range = 1.38-3.84; median = 2.81), and for the treatment group in the computerized classroom was 2.94 (range = 1.83 to 4.00; median = 2.93). The differences in the GPAs for the two groups were not statistically significant ($t(70) = 1.14$, $p = .26$). Chi square analyses indicated that groups did not differ in terms of gender ($\chi^2(1) = .65$, $p = .42$) or major ($\chi^2(6) = 3.46$, $p = .75$, but did differ in terms of class rank ($\chi^2(3) = 10.43$, $p = .02$), with seniors in the control group, not in the treatment group.[11]

Course Performance Outcomes

The four exam scores were highly correlated with one another (range: $r = .67$ to $r = .89$). ANCOVA information is in Table 2. A repeated measures ANOVA (RANOVA) tested group differences in exam scores. The sphericity assumption (i.e., variances of the exams was homogenous across the two groups) was met (Mauchley's $W = .86$, $p = .08$). Controlling for GPA, gender, and class rank, there was a significant effect of treatment group on exam scores ($F(1, 67) = 25.90$, $p < .001$), with the treatment group performing significantly better on exams than the control group.

Similarly, an ANCOVA tested group differences in total points attained in the course. After accounting for GPA, gender, and class rank, there was a significant effect of treatment group on total points attained in the course ($F(1, 67) = 32.54$, $p < .001$), with the treatment group earning significantly more points in the course (treatment group: M = 529.14 points, SD = 56.80; control group: M = 451.74 points, SD = 87.34).

An ANCOVA tested group differences in the other types of assignments in the course. After accounting for GPA, gender, and class rank, there was a significant effect of treatment group on the homework grade ($F(1, 67) = 9.566$, $p = .003$), but not on in-class exercises ($F(1, 67) = 14.557$, $p = .119$) or the out-of-class group project ($F(1, 67) = 9.796$, $p = .183$).[12]

Discussion and Implications

The Effectiveness of the Computerized Setting

This study suggests that not every assignment will necessarily benefit from the use of computers into the classroom. The evidence strongly supports, however, that the context of the computerized classroom setting is related to improved student performance (on examinations and homework).

Although the treatment group was comprised of mostly sophomores and freshmen, it outperformed the control group in the study indicating that upper class rank did not significantly improve academic performance in the introductory accounting courses. The differences in the GPAs for the two groups were not statistically significant.

Table 3 shows that the effects of group and GPA are significant statistically in explaining the variation in the performance of the students as measured by their total score in the class. As expected a higher GPA contributes positively to a student's total possible score of 600 points. On average, a one point increase in GPA contributes roughly 88.3 points to the student's total score. And for a student with similar GPA, being in the treatment group as opposed to being in the control group, contributes on average 63 points to that students score. This can be attributed to the effect of the computerized classroom.

It also appears that the computerized classroom had a stronger effect on non-seniors. When eliminating seniors from the data set, regression showed that a one point increase in GPA added 89.9 points to the score. But for non-senior students with similar GPAs, being in the treatment group now contributed 73 points to that student's score (an increase of 10 points).

[11] Since the control group was the only class with seniors, ANCOVA was calculated twice, both including and excluding the 5 seniors to see if this might cause a problem in comparability. Results did not change when seniors were excluded, thus only full sample results are reported.
[12] Results did not change when major was added to ANCOVA.

Student Satisfaction

The researchers also distributed an on-line survey to measure student satisfaction with the computerized classroom setting. Similar to prior studies, students expressed satisfaction with the computerized classroom. The means for all questions ranged from 3.43-3.86 indicating that students agreed or strongly agreed with the statements on the survey.[13] This was the first course students had taken in a computer lab setting (3.57), and the use of technology increased their understanding of the material (3.57). Respondents were comfortable using the technology in the classroom (3.86), and the majority thought the quality of instructional equipment in the course was excellent (3.57). All agreed the course met their learning expectations (3.57), and they would take another course in a computer lab setting (3.86). Students wrote no negative comments and a few favorable comments about the computerized setting including:

> *It was very useful being in a computer lab to do accounting. Using excel made working solutions easier as well as setting up balance sheets. I definitely recommend this for future acct. classes!*
> *This course was great! Helpful to have it in the computer lab, great for interaction! The professor was ALWAYS there for help! I learned so much in this course, but you must be willing to stay caught up with the information.*

Indicative of situated learning discussed earlier in this study, the instructor felt that students in the treatment group appeared to enjoy learning in the computer lab. During the semester, students made favorable comments about using the computers to learn accounting concepts and procedures. They also appeared to be more excited about learning and less apprehensive about accounting than students in the control group. With enhanced self-confidence using computers to solve problems, students commented that seeing the changes in the numbers as they worked problems on a spreadsheet helped them to better understand what they were doing. Some students in the treatment group even stayed in class after it was dismissed to continue to work on their assignments. On the other hand, the control group students were ready to leave before the instructor could say, “Class is dismissed.”

Implications for Accounting Education

Many accounting chairpersons believe that students using computers will not learn the concepts behind solving accounting problems.[14] They believe the traditional “pen and paper” approach is better. With all things held equal, however, this study found the opposite to be true. Students using the “pen and paper” approach in the classroom did not learn accounting concepts *better than* students in the computerized setting (as measured by exam and homework grades). Furthermore, another promising aspect of the computerized classroom is that improved student learning took place throughout the semester – a longitudinal benefit.[15] The evidence from the data analysis supports the first hypothesis.

The second hypothesis is partially supported: $\mathbf{H_{2a}}$ and $\mathbf{H_{2c}}$ are not supported and $\mathbf{H_{2b}}$ is supported. Homework scores were better in the computerized classroom, but scores on the final project and in-class exercises remained the same. Since many chairpersons contend there is a need for students to work through concepts on paper, we concede that using “pen and paper” might be more effective for improving certain types of learning. When the instructor created the exams, however, she did include questions that tested problem-solving and analytical thinking. We maintain, therefore, the evidence does not support the “widely-held” belief that students learn accounting concepts better in a “pen and paper” classroom setting.

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[13] This survey was completed by 19% of the class. Scale ranged from 1 (strongly disagree), 2 (disagree), 3 (agree) and 4 (strongly agree).
[14] Per the CTS, 47% of chairpersons believe students learning via technology lack a conceptual understanding of accounting principles.
[15] Students in the treatment group performed significantly better on all of the exams throughout the semester (Table 2).

What is at stake here? Who besides the researchers care about this research? Students should care because the use of technology in the classroom improves their learning and computer competency skills. Accounting programs, with existing computerized classrooms, should care and examine whether their labs are fully utilized to support student learning.[16] Accounting educators should care and consider how they use of technology in their current classes.

At the very least, chairpersons who want to add a computer lab to their program, should care about our findings.[17] If improving academic performance is a program goal, then adding a computer lab will improve the academic success of students. In fact, situated learning theory would purport that the computerized classroom is the best environment for students to learn in since it simulates how accountants do their work in the real world.

Finally, this study challenges administrators to commit resources for technology-enhanced classrooms. Such classrooms help students improve their proficiency with computer use, as expected by the professional business world. In addition, schools can add a monitoring program to the computerized classroom that gives the instructor control over student computer activity.[18]

Limitations

There are limitations to this study. The classes selected were a purposive sample, not a random sample. Because our findings represent a sample of only one university, the findings may not be generalizable to the population as a whole. This study, however, combined with prior studies, supports the notion that technology and certain computer applications (i.e. the use of templates) will enhance learning.

The possibility of implementer effect is another limitation. To minimize bias, the instructor made the effort to conduct the classes in the same manner, make assignments as similar as possible, and apply grading criteria similarly in both courses. It is possible, however, for instructor to have unintentionally influenced the results. We compared the student evaluations for both classes to see if there was evidence of the professor favoring one class over the other. On every item on the student evaluation, there were no statistically significant differences between the control and treatment groups.[19]

Conclusion and Future Research

With practitioners operating in technology-enabled environments, the accounting profession expects graduates to demonstrate technological competency upon graduation (AICPA, 2000). For this to occur, students must be active participants in the learning process or “learning by doing” is emphasized (AECC 1990, p. 309-310), rather than being passive recipients of information in a traditional learning environment.

This paper reveals several promising findings regarding situated learning, the context in which students learn. Improved performance in the computerized classroom did occur. It was not because one of the groups was smarter or more capable than the other. Rather, the differences were the result from the effect of a computerized environment on active learning. Although we did not find significant differences on every class assignment (nor did we expect it), this study shows that the use of a computerized classroom can serve as a win-win for students and accounting programs, helping students learn accounting concepts better while gaining computer competency skills.

To improve upon this study, future studies could be undertaken in upper level accounting courses to determine whether context, sample size, and the nature and content of courses influence student performance. In addition, a study that measures different types of learning would further address chairperson concerns. Finally, a longitudinal

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[16] Per the CTS, 67% of accounting programs used a computerized classroom.
[17] Per the CTS, 11% of chairpersons indicated wanting to add a computer lab to their programs.
[18] 20% of chairpersons expressed concerns that students might be distracted in a computerized setting with surfing the web or using *Facebook* during class.
[19] Detailed analyses available from the authors by request.

study of students in their careers could examine the long-term effects of a computerized learning environment on career preparation.

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APPENDIX 1

Chairperson Technology Survey

We are studying the benefits of computerized classrooms in accounting education. Your participation should take 3 - 5 minutes. There are no risks to you. All information is handled confidentially, and your responses will not be associated with your name in any way. No individual information will be reported; only averages will be reported in an academic journal. Your participation in this study is completely voluntary and you may withdraw at any time during this session without negative consequences, simply by exiting the survey. If you have any questions about the study, please feel free to contact Dr. Huber, Associate Professor of Accounting, at 330-941-3749. For further questions, contact the Director of Grants and Sponsored Programs, Edward Orona, at Youngstown State University at 330-941-2377. To participate in this research, you must be 18 years old or older.

Yes, I will participate.
No, I will not participate.

1. Does your program hold any of its accounting courses in a computerized classroom or lab?

Yes [Skip to 2]
No [Skip to 5]

2. In your computer classroom, do your students have access to software applications to work on examples and demonstration problems as presented by the instructor?

Yes
No

3. In your computer classroom, are all in-class and homework assignments completed on-line?

Yes
No

4. In your computer classroom, are exams taken on-line?

Yes
No

5. Questions about the use of computer software in your accounting program:

a. Has your program increased the use of software applications (e.g. Excel, Quickbooks) in the classroom over the last 3 years?
b. Is your program planning to increase the use of software applications over the next 3 years?
c. Do you have concerns about the impact of software applications on student learning?
d. Has your program increased the use of homework management systems (e.g. My Accounting Lab, Wiley Plus) in your courses over the last 3 years?
e. Is your program planning to increase the use of homework management systems over the next 3 years?
f. Do you have concerns about the impact of homework management systems on student learning?

6. Do you have a dedicated computer lab for your accounting (and/or business) students?

Yes, we have a lab
Yes, and we would like to conduct more classes in the lab
No, but we would like to have a lab
No, and we do not plan to add one in the next few years
Other, please specify

7. In regards to student learning, what do you see as the benefits of using technology (and software) in the classroom?

8. In regards to student learning, what do you see as the potential concerns about using technology (and software) in the classroom?

9. Type of institution

Public University
Private College or University

10. What country are you located in?

USA
Australia
United Kingdom
Other, please specify

11. Business accreditation

AACSB
ACBSP
IACBE
No specific business accreditation

12. Your position

Dean
Director or Chairperson
Faculty member
Other, please specify

13. How many full-time accounting faculty members do you employ?

14. What is the total enrollment at your university?

15. What is the enrollment in your accounting program?

16. Would you be interested in reading a study of the effects of a computerized classroom on student learning? Yes, No, Maybe? (When finished, we can send it to you if you give us your e-mail.) Thanks.

APPENDIX 2

Discussion of the Chairperson Technology Survey (CTS) Results

Accounting chairpersons listed in the *Directory of Accounting Faculty* (2011) were sent a link to the CTS survey. 1082 chairpersons, both in the U.S. and abroad, received the e-mail link. There were 892 active e-mail addresses of which 183 responded. The survey was conducted from May 24, 2012 to June 11, 2012.

Demographics:

The majority of respondents were from public universities (59%) versus private colleges (41%). 94% of respondents were from the U.S. and 6% from abroad. Accreditation was as follows: AACSB (57%), ACBSP (13%), IACBE (6%), and no business accreditation (23%). 78% of respondents were actual chairperson with deans and faculty members completing the rest of the surveys.

Current Computer Use:

62% of our respondents held classes in a computerized classroom or lab. 11% would like to add a lab. Although students have access to work on problems during class, only 27% of programs completed all assignments on-line and 29% gave exams on-line.

Trends in Computer Use:

Accounting programs plan to increase their use of software in the classroom over the next three years. At least a third of accounting chairpersons have no concerns about the impact of technology on learning, with 22% having "moderate to great" concerns about learning with accounting software packages and 32% about OHMS.

Tabulation of Results
The use of computer software in your accounting programs

	Not at all	Slightly	Somewhat	Moderate	To a great extent	Not sure
Has your program increased the use of software applications (e.g. Excel, Quickbooks) in the classroom over the last 3 years?	16%	19%	20%	28%	16%	1%
Is your program planning to increase the use of software applications over the next 3 years?	13%	12%	26%	26%	14%	8%
Do you have concerns about the impact of software applications on student learning?	38%	12%	24%	14%	8%	3%
Has your program increased the use of homework management systems (e.g. My Accounting Lab, Wiley Plus) in your courses over the last 3 years?	13%	13%	17%	25%	32%	1%
Is your program planning to increase the use of homework management systems over the next 3 years?	15%	18%	22%	20%	15%	11%
Do you have concerns about the impact of homework management systems on student learning?	34%	15%	16%	15%	17%	3%

Qualitative Responses:

Benefits

The leading qualitative response (67%) about the benefits of using technology in the classroom was that it mirrors the “real world” and better prepares students for careers. About 40% of chairpersons felt technology supported learning by giving students immediate feedback, practice, and self-paced learning. Only 5 of 127 respondents thought students learned better (i.e. understanding complex problem-solving) using technology.

Concerns

The leading qualitative response (47%) about the concern of using technology was that students do not learn the concepts behind the accounting techniques. Since they do not make manual entries or skip steps in the process, students do not grasp the fundamental concepts. About 20% of chairpersons were concerned about cheating and another 20% about students being distracted by other technologies (i.e. Facebook) when using the computer in the classroom.

Table 1

Descriptive Statistics

	Control Group (Traditional Classroom)		Treatment Group (Computerized Classroom)	
Gender	N	%	N	%
Female	11	31	15	41
Male	24	69	22	59
Total	35	100	37	100
Major	N	%	N	%
Accounting	4	11	3	8
Business	22	63	19	51
Non-business	9	26	15	41
Total	35	100	37	100
Class Rank	N	%	N	%
Senior	5	14	0	0
Junior	9	26	4	11
Sophomore	13	37	16	43
Freshmen	8	23	17	46
Total	35	100	37	100

GPA	Control Group	Treatment Group
Mean	2.78	2.94
Median	2.81	2.93
Maximum	3.84	4.00
Minimum	1.38	1.83
Range	2.46	2.17

Exams	Control Group	Treatment Group
1	66%	84%
2	69%	84%
3	72%	87%
4	74%	82%

Table 2

ANCOVA Results

Total Exams	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	177560.458[a]	4	44390.115	27.142	0.000
Intercept	11126.566	1	11126.566	6.803	0.011
GPA	119106.907	1	119106.907	72.828	0.000
Gender	3988.500	1	3988.500	2.439	0.123
Class rank	4639.736	1	4639.736	2.837	0.097
group	42353.063	1	42353.063	25.897	0.000
Error	109575.194	67	1635.451		
Total	7180939.000	72			
Corrected Total	287135.653	71			

Total Points	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	316095.293[a]	4	79023.823	31.682	0.000
Intercept	71256.671	1	71256.671	28.568	0.000
GPA	199845.903	1	199845.903	80.123	0.000
Gender	1146.140	1	1146.140	.460	0.500
Class rank	9852.899	1	9852.899	3.950	0.051
group	80949.439	1	80949.439	32.454	0.000
Error	167114.693	67	2494.249		
Total	1.788E7	72			
Corrected Total	483209.986	71			

Homework	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	5062.147[a]	4	1265.537	6.235	0.000
Intercept	9120.372	1	9120.372	44.933	0.000
GPA	1236.851	1	1236.851	6.094	0.016
Gender	632.341	1	632.341	3.115	0.082
Class rank	97.908	1	97.908	.482	0.490
group	1941.780	1	1941.780	9.566	0.003
Error	13599.506	67	202.978		
Total	593075.000	72			
Corrected Total	18661.653	71			

In-Class Exercises	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	39.882[a]	4	9.971	1.710	0.158
Intercept	4230.854	1	4230.854	725.793	0.000
GPA	8.426	1	8.426	1.445	0.233
Gender	8.400	1	8.400	1.441	0.234
Class rank	2.368	1	2.368	.406	0.526
group	14.557	1	14.557	2.497	0.119
Error	390.562	67	5.829		
Total	174874.000	72			
Corrected Total	430.444	71			

Group Project	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	29.238[a]	4	7.309	1.350	0.261
Intercept	4161.819	1	4161.819	768.663	0.000
GPA	3.799	1	3.799	.702	0.405
Gender	7.889	1	7.889	1.457	0.232
Class rank	.178	1	.178	.033	0.857
group	9.796	1	9.796	1.809	0.183
Error	362.762	67	5.414		
Total	166280.000	72			
Corrected Total	392.000	71			

Table 3

Multiple Regression Results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.795[a]	0.632	0.621	50.80

a. Predictors: (Constant), group, GPA

ANOVA[b]

Model		Sum of Squares	DF	Mean Square	*F*	Sig.
1	Regression	305183.2	2	152591.577	59.142	0.000[a]
	Residual	178026.8	69	2580.099		
	Total	483210.0	71			

a. Predictors: (Constant), group, GPA
b. Dependent Variable: Totalpts

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	*t*	Sig.
1	(Constant)	269.5	30.83		8.741	0.000
	GPA	88.3	10.10	0.645	8.748	0.000
	group	-63.1	12.09	-0.385	-5.219	0.000

a. Dependent Variable: Totalpts

Dependent variable: Totalpts = Total points earned by the student in the course out of 600 points maximum. Equal to the sum of points earned on: 4 exams (400), 1 small-group project (50), 10 individual homework assignments (100), and 10 individual in-class assignments (50).

Independent variables: GPA = Student's cumulative GPA (on a 4.0 scale) at the start of the semester.

Independent variable: GROUP = Coded as "0" if the student was in the control group (computers were not used) and coded as "1" if the student was in the treatment group (computers were used).