Using A Web-Based Homework System In A Managerial Accounting Course: Does It Help Students To Learn?

John L. Haverty
St. Joseph's University
5600 City Ave.
Philadelphia, Pennsylvania, USA
jhaverty@sju.edu

Abstract

Use of web-based homework systems has been rapidly increasing in accounting courses and other business disciplines. This study investigates whether the use of such systems increases student learning in a first-year managerial accounting course. A group of students used a web-based homework system, and their scores in a standardized final examination were compared to a control group of students who did not use the web-based homework system. Student learning was not adversely affected. Given the obvious savings in instructor clerical effort, this finding makes the use of a web-based homework system an attractive option.

Introduction

University educators have been constantly searching for innovative ways to increase students' learning. In recent years, however, education in general has been the beneficiary of a stream of new technologies that offer great potential to facilitate student learning. One such innovation has been the use of web-based homework systems. These systems allow professors to use internet technology to assign homework problems that can be coordinated with the assigned textbook. Students are able to complete these problems online and their work is automatically graded. The instructor can control the number of attempts permitted before a final grade is recorded as well as the amount and timing of the feedback given. Feedback to the student could be as little as an overall grade, or as detailed as a complete explanation of every question in the assignment. Timing of the feedback can also be controlled by the instructor: it could be given immediately after a single attempt, it could be given after the completion of all attempts permitted for the assignment, or it could be delayed until the assignment is due for all students. The instructor also has the option of generating algorithmic assignments, meaning that each student can receive an individualized assignment on a given managerial accounting problem having the same logical structure but different numbers. This makes copying an assignment more difficult for students, providing the instructor with a supposedly more valid assessment opportunity. In addition, the instructor can generate online quizzes and control the number of attempts a student is given for the quiz and can control the amount and nature of feedback given to the student after each attempt.

Web-based homework systems have become increasingly attractive due to difficult economic circumstances facing higher education. Universities are under tremendous financial pressure as a result of shrinking endowments, reduced government funding, increased tuition sensitivity on the part of parents and students, and reduced contributions. In some academic disciplines, this situation has been compounded by intense competition to hire qualified faculty in the face of steady or even increased student demand. For example, the number of students wanting to major in accounting is holding fairly constant, but salaries for qualified accounting faculty are increasing due to a limited supply. As a result, universities are increasing the number of students enrolled in such courses without adding additional faculty, placing a great deal of pressure on faculty teaching those courses. Clerical duties such as grading homework and/or examinations are increasing, but resources to support those efforts such as teaching assistants are being reduced at many colleges and universities across the country. As a result of these financial pressures, accounting educators are searching for ways to cope with increasing class sizes by reconsidering how or if they assign homework to students. The increasing availability of web-based homework systems is causing educators to consider their use, but their effectiveness in increasing learning is a question that needs to be studied.

The remainder of this paper is organized as follows. Prior research on the use of homework in accounting is discussed as well as the limited research on the effectiveness of web-based homework systems. A research hypothesis is formulated, the research methodology and data analysis are described, and the results are presented. Finally, the implications and limitations of this research are discussed.

Prior Research

Since web-based homework systems are a recent innovation, there has naturally been little prior research on the effect of these systems on student learning. Some research on the effect of homework in general on student learning in accounting is first addressed, followed by a look at some research on web-based homework systems in both accounting education and other academic systems.

In accounting, as well as in other quantitative business disciplines, the use of assigned homework problems and exercises have long been a part of most accounting courses in the curriculum. Despite this traditional use of homework in accounting courses, only a few researchers have attempted to test the assumption that doing homework increased students' learning in accounting courses. Reported results have been mixed. Eskew and Faley (1988) used examination performance as a surrogate for learning, and reported that student effort was the largest contribution to the variance in examination performance. Their model, only explained 54% of the variation, and other variables contributing to this 54% explanation of the variance included aptitude, previous collegiate performance, and previous specific and related academic performance. Rayburn and Rayburn (1999) reported that students who consistently complete homework perform better on exams. They noted in the limitations of the research that this might have less to do with the homework itself and more to do with the possibility that, to begin with, such students are

more intelligent and more interested in the course than those who do not complete homework. Not all classes were taught by the same instructor. In addition there were other differences in scheduling. In an introductory operations management course, Peters et al. (2002) report that requiring graded homework had a negative effect on examination performance. Despite these mixed results, most accounting instructors continue to make heavy use of homework.

Over the years, instructors in accounting and other quantitative business disciplines have tried different methods to encourage and/or require students to do homework. These methods vary in terms of labor intensity. At times, homework would be collected and graded. At other times, homework was ungraded and simply reviewed in class. Sometimes solutions were provided in class, and sometimes solutions were made available to the students outside of class. The use of the computer and the internet have made more options available to instructors to balance the assumed value of homework with the clerical effort and expense in collecting, grading, and providing feedback to students. Friedman (1981) reported an early use of the effect of computer usage on student achievement, and noted that students who completed their homework with the assistance of supplemental pre-written computer programs achieved a higher level of achievement in an intermediate accounting course than students who did not utilize the computers. Lindquist and Olsen (2007) tested the association between providing no homework solutions, providing check figures, or providing completed solutions on students' knowledge gains and perceptions of learning and satisfaction. They found no significant difference in test scores across experimental conditions, but did find that students who were not provided with check figures or homework solutions were the least satisfied and reported the highest levels of frustration while completing their homework assignments. These students, however, report the greatest amounts of learning and have the highest levels of satisfaction with their posttest grades. Bikitmirof and Klassen (2008), in an introductory finance course, showed that access to homework solutions was associated with student performance, and that access to specific files, rather than access to online course materials in general, was associated with better student performance.

Since web-based homework systems are quite new, there has been little research involving their use and effectiveness. Peng (2009) studied use of a web-based homework system in a financial accounting course. Results showed that individual intrinsic motivation and computer efficacy are important factors in determining effort and whether students perceive the system to be useful. Peng did not attempt to show that the use of the online homework had any impact on student learning, however.

Researchers in other disciplines have also studied web-based homework systems with mixed results. Bonham et al. (2001) used an early version of an online homework manager in a physics class. They concluded that web-based homework does not bring significantly greater benefits to students than pencil and paper homework, but neither does it do much worse than standard methods of collecting and grading homework. Cheng et al. (2004) however, concluded that using an online homework manager did increase students' learning of introductory physics. Smolira (2008) found that students in an introductory finance course felt that online homework was preferable to traditional

homework assignments that are turned in to the instructor. Students also reported that online homework assignments increased their understanding of the material and time they spent in preparing for the class. Fyneweaver (2008) concluded that web-based homework is as effective as paper-based homework for student learning in a general chemistry course, but did not report any increased learning as a result of the use of web-based homework. The study noted several advantages to the instructor, including reduction of time spent grading, recording, and returning paper-based homework. Palocsay and Stevens (2008) tested the use of web-based tutoring systems in a business statistics course and concluded that the type of system used to deliver homework made little difference in student success.

In summary, prior research shows that students and instructors perceive web-based homework systems to be useful. Research on the effect of web-based homework systems on student learning has been limited, however, and the results have been mixed. No clear positive effect on actual student learning has been demonstrated.

Research Questions and Hypotheses

This study tests the relationship between the use of an online homework manager and student learning in a managerial accounting course. It extends the work of Rayburn and Rayburn (1999) who reported that students in an accounting class who do more homework perform better on exams. Logically, we should see this relationship for a web-based homework system, but researchers investigating the use of web-based homework systems in other disciplines such as Palocsay and Stevens (2008) have shown less than encouraging results. This study also extends the work of Peng (2009), who tested a web-based homework system in a financial accounting course, and examined the effect of web-based homework systems on student effort and perceived usefulness, but did not examine the effect of a web-based homework system on learning. The specific research question is:

> **Research Question:** Do students who use a web-based homework system perform at a higher level than students who do not use a web-based homework system?

This question is addressed via a quasi-experimental design in which scores on a common final examination of a group of students who used the online homework system are compared to a similar group of students who used traditional non-graded homework assignments. The use of an examination as a surrogate for learning is consistent with Eskew and Faley (1988), Rayburn and Rayburn (1999), and Peters et al. (2002). We express this research question in the form of a null hypothesis as follows:

> **Hypothesis:** The grades in an in-class, pencil-and-paper examination of students who used a web-based homework system throughout the semester should be the same as the grades in an in-class, pencil-and-paper examination of students who did not use a web-based homework system throughout the semester.

If the online homework system had a positive effect on student learning, we would expect that a group of students using the web-based homework system would achieve higher scores in the same in-class pencil-and-paper examination than students who used the traditional ungraded homework approach to managerial accounting.

Methodology and Data Analysis

The online homework system was tested in three sections of a managerial accounting course taught in the spring semester of 2009 at a mid-sized urban private university. There were 18 sections of managerial accounting taught that semester, 17 of which served a traditional full-time day student population. There were 725 students registered in these 17 sections. At this university, managerial accounting is required for all business school students, and is normally taken during the second semester of a business student's first year, with its prerequisite, financial accounting, taken in the first semester. The section taught in the evening was excluded from this study since those students are normally older students working full-time and are chosen by a different admissions mechanism.

The accounting department in this university has a long tradition of course coordination, consisting of a common syllabus for all sections. The common syllabus includes a set of specific required chapters, and a baseline set of required exercises and problems. Each faculty member teaching a section of this course constructs their own midterm examinations and any other assessments used in their own sections. PowerPoint slides used by all instructors are made available to all students via the same course management system. Solutions to the assigned homework problems are made available to all students via that same system. Instructors generally do not grade homework assignments but review them in class after they have been assigned. In addition, there is a common baseline final examination consisting of 50 multiple choice questions from the entire common syllabus. A faculty member who is not the course coordinator is designated as the examination coordinator. This faculty member is responsible for preparing a bank of approximately 150 questions for the final examination. This bank is then routed to all the instructors teaching the course who are free to strike questions they feel are either inappropriate or poorly worded. From the remaining questions, the examination coordinator selects the final 50 questions for the common examination. Instructors are free to add additional content to their own course as long as they incorporate the baseline syllabus. Likewise, each faculty member is free to include additional final examination questions into their own final examinations as long as they include the baseline common 50 questions. In practice, however, faculty who have taught managerial accounting have not added content beyond the baseline syllabus and have rarely asked additional questions in their own final examinations. The result is a common syllabus and a common final examination taken by all sections. University regulations require a final examination weighted as roughly one-third of the student's final grade. This system has been in place at this university for at least 20 years.

As a result of this tightly coordinated structure, all 17 sections of managerial accounting were taught from a common syllabus and a common baseline set of required homework problems, with instructors generally not grading the homework. The solutions to these problems are discussed in detail in all classes and are made available to all students via a course management system. Of the 17 sections of managerial accounting, the three sections taught by the course coordinator used an online homework system as a mechanism to assign, check and grade the same homework that was required by all students taking this class. There were 135 students in these three experimental sections. Students self-selected the section and the instructor as part of their normal registration process. They were not aware that they would be using an online homework system when they registered for the course, but they were informed of it about a week before the course formally began. This was before the end of the add-drop period, when the students could change courses or sections as part of the normal process. The department chair monitors add-drops for unusual movement in order to balance workload and identify any classroom problems. No unusual movement was noted during this experiment, reducing the possibility of self-selection bias in the experimental and control groups. Other sections used the traditional ungraded homework system in which the homework was neither collected nor graded, but was reviewed in class. At this university, ungraded homework has been the traditional method of delivery of the managerial accounting course. The final examination has been weighted roughly the same by all instructors in this course, reducing, but not completely eliminating, the possibility of incentive effects as a result of differential weighting of the final examination.

This structure results in an opportunity for testing an online homework system in a quasi-experimental situation. Sections using the traditional ungraded homework procedure (14 sections) can be compared to an experimental group (three sections) using an online homework system. The existence of a common final examination across all sections results in a common measure of learning that can be used to assess the performance of the experimental group versus the overall population.

Results

The study did not obtain significant evidence to reject the hypothesis tested:

Hypothesis: The grades in an in-class, pencil-and-paper examination of students who used a web-based homework system throughout the semester should be the same as the grades in an in-class, pencil-and-paper examination of students who did not use a web-based homework system throughout the semester.

Table 1 shows the results of the final examination (50 questions) by instructor by year, and calculates means for the experimental group (Instructor A) for all three years of the study as well as means for the non-experimental group (Instructors B through J and disabled students). Three years of data were collected in an effort to control for different instructors. The experiment took place in the year 2009, and all instructors used similar non-graded homework in the years 2007 and 2008.

Table 1: Final Examination Scores, Experimental Group and Non-experimental Group

	2007			2008			2009*		
Instructor	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**	**N**
A	29.96	7.17	73	31.85	7.67	78	29.22	6.62	125
B	30.34	7.46	50	33.61	7.11	92	32.32	7.12	102
C	31.00	7.70	20				27.16	5.96	80
D	30.68	7.07	153						
E	28.99	6.85	117	30.93	6.68	188			
F	35.46	6.91	78	37.44	6.85	120	33.77	7.15	164
G				32.20	7.22	80	29.72	5.83	85
H							26.27	5.15	32
I							30.08	7.72	67
J							31.78	8.42	18
Disabled Students	31.30	7.25	10	27.75	7.26	4	31.29	7.61	29
Experimental Mean (Instructor A)	29.96		73	31.85		78	29.22	6.62	125
Non-experimental Mean (Instructors B-J)	31.08		428	33.24		484	30.97		577
Grand Mean	30.92		501	33.04		562	30.66		702

*The year of the experiment was 2009. In 2009, the experimental group used the web-based homework system, and the non-experimental group used the traditional non-graded homework teaching methodology. In 2008 and 2007, all instructors used the non-graded homework methodology.

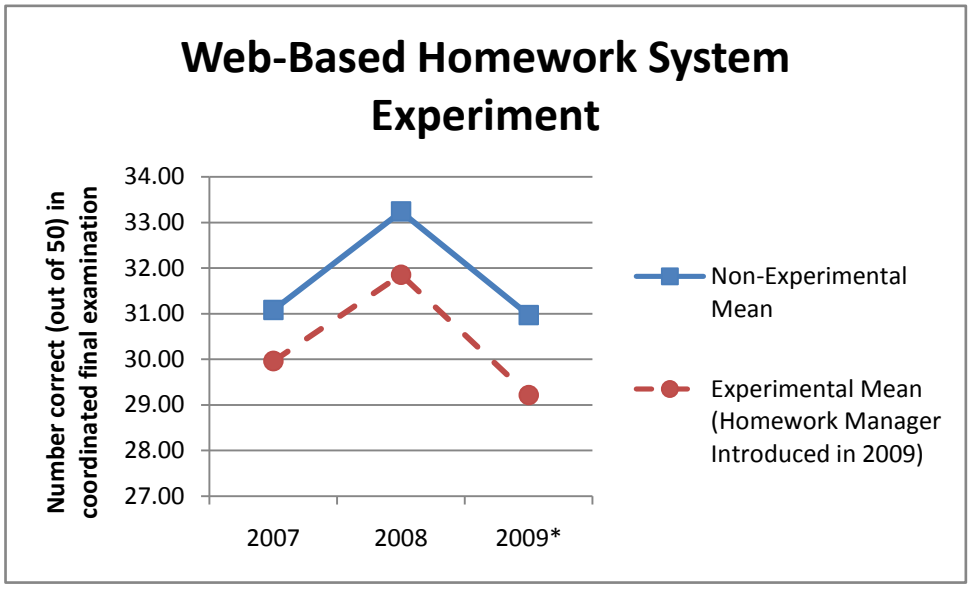
Students with disabilities took the examination in an untimed setting and were grouped and tabulated separately. In 2009 there were 29 disabled students in all sections, and 6 of them were from the experimental group. Disabled students were taught by all instructors and included 6 students from the experimental group in 2009. These numbers were judged to be too small to affect the results of the study, so no attempt was made to separate the disabled students by instructor.

In the experimental year, 2009, the mean of the experimental group is 29.22 correct out of 50 questions. The control group in the same year had a mean of 30.97 correct. The experimental group had a slightly lower performance than the control group. If the web-based homework system had a positive effect on student learning, we would have expected that the mean student score on the final examination would have been higher for the experimental group than for the control group. This was not the case, and in fact the experimental group had a slightly lower mean score than the control group.

A possible confounding effect in this research design would be the role of the instructor. The effect of the instructor can be controlled by noting that in 2007, students of the instructor conducting the experimental group performed at roughly 1 point below the students of the non-experimental group (Experimental group-29.96, non-experimental group-31.08). In 2008, this difference increased slightly (Experimental group-31.85, non-experimental group-33.24). In 2009, the year of the study, the difference increased a bit more (Experimental group-29.32, non-experimental group-30.97). If the online homework system increased student learning, we would have expected the difference between the experimental group and the non-experimental group to shrink or to perhaps reverse itself, but this was not observed. Therefore we cannot reject the null hypothesis that students using an online homework system achieved different scores in a common final examination. Thus, this study offers no evidence that use of an online homework system increased student learning. On the other hand, it can be said is that the use of an online homework system did not have a measureable negative impact on student learning in this experiment.

This argument is summarized visually in Figure 1, which summarizes the results of the experiment. This exhibit compares the means for the experimental group with the means for the non-experimental group over a three-year period, with the last year (2009) being the year of the experiment. In years 2007 and 2008, all instructors in the study used a similar ungraded homework teaching methodology.

Figure 1: Final Examination Results, Experimental Group Compared to Non-experimental Group



*Indicates the experimental year

Conclusions

The study found no evidence that the use of a web-based homework system actually increased student learning. In fact there was a slight decline in the performance of students using a web-based homework system as compared to students who did not use a web-based homework system, when instructor and exam difficulty were controlled using a common, coordinated in-class pencil and paper final examination. There was no significant decline in student performance, however, and if the web-based homework system actually reduces the clerical effort involved in teaching an accounting course, then the use of a web-based homework system becomes quite an attractive consideration.

Implications for Research

This experiment provided no evidence of increased student learning as a result of the use of a web-based homework system. This finding is consistent with prior research including Bonham et al. (2001) in physics, Fynewever (2008) in chemistry, and Palocsay and Stevens (2008) in operations management who were unable to find a relationship between the use of a web-based homework system and student learning. This research extends the work of Peng (2009) in accounting who studied student perceptions of online homework systems in financial accounting. The study reported here was done in a managerial accounting class, and did examine the impact of web-based homework systems on student learning.

Limitations

This study took place in a particular experimental context, and the results of the study may not be generalizable outside of that particular context. The study took place in a managerial accounting course in one particular university. The students in this course were primarily business students, with accounting students constituting only a small majority.

The quasi-experimental nature of this study has several possible weaknesses. Selection bias is possible since students self-selected whether or not they were in an experimental section. This effect is minimized, however, by noting that there was no abnormal adding or dropping of sections after the announcement of the use of the web-based homework system was announced. There is also the possibility of an incentive effect in the experimental group due to differential weighting of the final examination by various instructors. This possibility is mitigated, however, by university policy that requires all instructors to have a final examination in all courses that comprises approximately one-third of a student's final grade.

One set of parameters were used in the online homework system, and a huge number of possible variations in the specific implementation of the web-based homework system are possible, and these variations may have a significant effect on student educational

outcomes. Finally, this study used one particular online homework system from one publisher. Results might not be comparable with other online homework systems.

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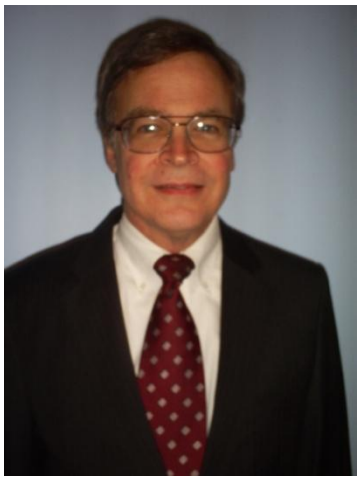
Biography



John L. Haverty is an Associate Professor of Accounting at the Haub School of Business at St. Joseph's University in Philadelphia. His research interests are in accounting education, managerial accounting and international accounting emphasizing China. Dr. Haverty's research has been published in *Issues in Accounting Education*, *Journal of International Accounting, Auditing and Taxation*, *Advances in Managerial Accounting*, *Journal of Business Research*, *Industrial Marketing Management*, and *Journal of Services Marketing*.