SBAJ: Volume 10 Number 2 (Fall 2010) 84 - 103

IS ELECTRONIC-BASED HOMEWORK SYSTEM AN EFFECTIVE TOOL FOR TEACHING AND LEARNING THE FUNDAMENTALS OF ACCOUNTING?

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ABSTRACT

The proliferation of technology in academe has led to the use of electronic resources such as electronic-based homework (EBH) system to improve students' homework experience. EBH provides timely feedback as students complete homework assignments and immediate assistance on problems that they find difficult. The purpose of this study is to examine the effectiveness of electronic-based homework in accounting pedagogy by comparing students' utilization of EBH system and their performance in the course. Hence, the study attempts to answer the following question: does the level of student utilization of an EBH system correlate positively to students' performance in the course?

INTRODUCTION

The essential point of learning is reflected in the Ancient Chinese proverb by Confucius, which states, "Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand." In our experience, as students and teachers, being involved in homework assignments is one of the most effective ways to learn, particularly in accounting pedagogy. The Accounting Education Commission (AECC) advocates the model of "learning to learn" as a goal that educators should strive for in accounting education, especially in the first accounting course. The premise of the "learning to learn" is that "programs focused on teaching students how to learn must address three issues: (1) content, (2) process, and (3) attitudes." (Sundem 1999[1]). The concept of homework, not only provides an avenue for achieving "learning to learn, but also strengthens the idea of learning by doing. However, the effectiveness of homework on learning may be limited where the learning resources are not utilized.

In the paper-based homework system, accounting students often express frustration when they "get stuck" and are unable to receive immediate assistance or feedback on a problem or exercise that proves to be difficult for them to solve. Often students claim that they spend many hours "pulling their hair out" because they could not get timely assistance on difficult homework problems. Fortunately, such experiences are becoming a thing of the past due, in part, to the technological resources that are now available to mitigate the dreadful experience of "getting stuck" when doing homework.

The proliferation of technology in academe has led to textbooks and teaching resources using electronic resources to improve students' experience in doing homework. One such electronic resource is the electronic-based homework (EBH) system. EBH provides timely feedback to students as they complete the homework assignments and allows them to obtain immediate assistance on problems that they find difficult to solve. The EBH system offers an opportunity for students to enhance their learning. As noted by Zisow:

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[1] Page 3 of the Printout of Chapter 6 of The Accounting Education Change Commission: Its History and Impact.

Extending the use of technology to the home by assigning meaningful homework accomplishes three goals. First, it encourages meaningful homework assignments designed to meet the individual reinforcement needs of students. Second, it provides practice of valuable technology skills that will serve students well beyond the completion of the homework itself, and third, it provides students with homework activities that are engaging and fun, perhaps alleviating once and for all the age-old question, "Do I have to do my homework?" (2002:41). Hence, EBH has become a relevant pedagogical tool.

The purpose of this study is to examine the effectiveness of electronic-based homework in accounting pedagogy by examining the influence of students' utilization of EBH and their performance in the course. Hence, the study attempts to answer the following question: does the level of student utilization of an EBH system correlate positively to students' performance on tests and overall success in the course? To answer this question, we collected and analyzed data from university-level principles of accounting classes where EBH was utilized over a period of four years.

Following this introduction, the first section provides background information on electronic-based homework systems as a teaching tool and the theoretical underpinning for the study. The second section presents the research methodology, the third section discusses the data analysis and results, and the fourth section offers the conclusion with discussions about future research opportunities in the use of electronic-based homework systems.

THEORETICAL FOUNDATION

Studies have been done and much has been written about the need to improve accounting pedagogy. The primary conclusion is that introductory accounting courses should be designed to provide opportunity for educators to provide basic accounting knowledge and improve students' performance in accounting, and thereby attracting students to choose accounting as their major area of study (Arendale, 1994; Albrecht and Sack, 2000) .

Several studies have examined the effect of supplemental instruction (SI), as well as tutorial services, on student performance in

"high-risk courses" such as introductory accounting. SI is a cooperative learning measure to create and provide out-of-class study session to students, and to encourage students to be actively engaged in their own learning process. Studies show that SI and tutoring have a positive impact on student performance (Arendale , 2006; Jones and Fields, 2001; Etter, et al., 2000). Merrill, et al. (1992) compared the role of human tutors and intelligence tutoring systems (computer-based tutoring) on student learning. The result of the study indicated that human tutoring service was "more flexible and more subtle" than that offered by intelligence tutoring (Merrill, et al., 1992, 277). Nonetheless, the authors concluded that the use of intelligence tutoring techniques can result in "substantial cognitive and motivational benefits" to students (Merrill, et al., 1992, 301).

Similarly, studies provide evidence of the effectiveness of homework assignment on students learning. The role of homework in learning has been extensively studied, particularly at the elementary and secondary levels of learning. Literature is replete with evidence of a direct, positive relationship between homework and student performance, where performance serves as a proxy for learning. Several studies conclude that in schools where homework is implemented, students attain high levels of performance (Keith, 1982; Rutter, Mortimer, Ouston, and Maughan, 1979). Hence, homework is a vital part of the education structure.

LaConte (1981) classified homework into three objective categories of *preparation*, *practice*, and *extension*. According to Eddy (1984), the purpose of: 1) *preparation* homework is to provide background information on the concepts and principles being taught (research), 2*) practice* homework is to reinforce newly-learned concepts and principles (problem solving), and 3) *extension* homework is to encourage creative learning and critical thinking (case analysis). The goal of homework assignments in accounting focuses on achieving the three categories. While extant literature provides ample evidence demonstrating the effectiveness of homework in learning at the primary and secondary education levels, it is conceivably safe to expect that the same is true at the institutions of higher learning. Similar to the field of mathematical science education, the concept of learning by doing is relevant in accounting education. As students devote time to

doing exercises and working accounting problems, they enhance their learning of the subject matter.

Technology has become an important tool in teaching as it provides flexibility and user-friendly programs for administering homework assignments to students. Technology has also provided a means for instructors to monitor their students' homework activities more efficiently than in the paper-based system. Feedback on students' performance on electronic homework also allows the instructor to identify specific areas in the course material that pose significant challenges to the students. With this knowledge, the instructor can modify the classroom lectures and discussions accordingly to address those areas. Hence, in this study, we are interested in assessing the effectiveness of electronic-based homework as a teaching/learning tool.

Although the role of electronic homework in education at the primary and secondary education levels has been studied, very little work has been done to assess the contribution of electronic homework system as an effective educational tool at the institutions of higher learning, particularly in accounting education. Thoennessen and Harrison (1996) reported on the use of Computer-Assisted Personalized Approach (CAPA) system, an electronic-based homework program, in introductory physics classes and concluded that "using CAPA has proven to be an effective tool which is very much appreciated by the students." (8).

Bonham et al. (2003) compared student performance when web-based homework was utilized to when paper-based homework was utilized in the college-level physics course. They concluded that there was no significant difference in student performance between computer-based assignments and paper-based homework. Despite the divergence of results, literature suggests that homework assignment, in either form, electronic-based or paper-based, is beneficial to learning.

Electronic-based homework provides a resource to help students take ownership of their own learning and study efforts. During the four years that EBH was utilized in the principles of accounting course, two different textbooks that provided an EBH system were used. The topics covered in the textbooks and their respective EBH systems were comparable. The EBH system for one was Eduspace, and the EBH system for the other textbook was called Homework Manager. Eduspace was used in principles of accounting

course from 2006 to 2008, and Homework Manager was used in the same course from 2008 to 2010. The accounting instructor in this study utilized EBH system to encourage students to augment their classroom learning. The EBH systems were valuable because they provided additional practice for students to supplement in-class homework problems and discussions.

The designs of both Eduspace and Homework Manager were similar. Each EBH system contained objective conceptual and computational questions, algorithmic short exercises and problems for each chapter of the textbook. The EBH system allowed students to receive instantaneous feedback as they completed each exercise/problem or upon the completion of the entire assignment. Affouf and Walsh wrote that "if students get an immediate response to their homework, they are more likely to correct any misconceptions they may have with a particular topic." (2007:164). The EBH systems allowed students to receive help in the event that they did not know how to complete a problem or an exercise. The systems had the "Hint" feature, which navigated the students to the relevant section in the electronic version of the textbook where the concept of the problem was explained. This feature mitigates students' experiences of "getting stuck" and being unable to complete homework assignments. Therefore, this study examines the impact of the level of student utilization of electronic-based homework (EBH) system on performance. We conjecture that EBH is an effective learning tool; therefore, our main hypothesis is that:

H1: The level of student participation in EBH will have a direct relationship with student performance in the course.

Wooten (1998) discusses several factors that influence student learning in Introductory Accounting classes. He presented a model of student performance that listed aptitude, efforts, family, grade history, motivation, extra-curricular, work, student expectation, and learning environments as factors influencing student performance. While our study is not designed to examine all these factors, we consider the roles of collegiate GPA (a proxy for aptitude/grade history), and efforts/motivation in examining the impact of EBH on student performance in the course. In considering the impact of aptitude/grade history, we hypothesize that:

H2: The influence of EBH participation on student performance is significantly different between strong and weak students.

In determining the influence of the efforts/motivation factor on student performance, we further hypothesize that:

H3 The performance of the EBH participating students will be significantly higher than the performance of the EBH non-participating students.

METHOD

The design of our study is quasi-experimental and observational. We examined the records of 450 students who enrolled in seventeen sections of the principles of accounting classes over a period of four years (from fall 2006 to spring 2010) at a four-year public university. The records of students who withdrew from the course or did not participate in all four tests (three tests and a final examination) given in the course were eliminated from the data. As a result, 297 records were usable.

Each student was assigned a personal access code (provided with the textbook by the publisher). The access code allowed the student to enroll in the EBH system. Upon enrolling in EBH system, the student was required to set up personal username and password which were used to access the EBH assignments.

The EBH systems used in the course consisted of objective questions, static and algorithmic exercises and problems. The purpose of utilizing the EBH systems was to encourage students to earn perfect scores on the assignments. To this point, students were allowed to retake the assignments as many times as they desired. With algorithmic problems, the students received a different set of facts for the problems with each retake. Allowing students to rework assignments encouraged them to continue to do the exercises until they learned the material. Each chapter assignment contained a total of ten exercises and problems. As a way to boost student learning, students were required to complete the electronic homework assignments on "as you go" basis. Hence, students were awarded credit up to 10% of the overall course grade for doing the EBH assignments, a motivation

factor to encourage students to utilize EBH in their learning process. Students received credit for completing EBH assignments only if they completed the chapter assignment by the next class meeting after the completion of the related chapter. The percentage of EBH assignments completed was the basis for awarding EBH credit. Despite the motivation, ten students did not participate in the EBH assignments.

The sections of the course examined in this study were taught by the same instructor, and identical sets of EBH assignments were assigned in all sections. The contents of the tests and final examinations were similar, although some descriptive components in the tests (such as names, facts and amounts) were changed. The instructor preserved the integrity of test materials by retaining students' tests to prevent them from being circulated. The mean of the student's test scores served as proxy for performance in the course, the dependent variable, and the level of student participation in the EBH assignments is the independent variable.

For the purpose of our analysis, we assigned students into four groups: participating students (EBH), Non-participating students (non-EBH, strong students (STRONG) and weak students (WEAK). There were 287 students in the EBH and 10 students in the non-EBH groups. To assign students into the STRONG and WEAK groups, we calculated the mean of the 297 students' collegiate GPAs which was used to assign the students. The overall mean GPA was 2.80. Students with GPA of 2.80 and higher were assigned to STRONG and students with GPA below 2.80 were assigned to WEAK. As a result, there were 157 students in the STRONG group (154 EBH and 3 non-EBH) and 140 students in the WEAK group (133 EBH and 7 non-EBH). Table 1 presents the descriptive statistics of the data.

We used the regression, analysis of variance (ANOVA) and analysis of covariance (ANCOVA) to analyze the data for testing the impact of EBH on student performance. We also analyzed and compared the mean test scores of the participating and non-participating students.

RESULTS

The descriptive statistics of the data are presented in Table 1, which consists of three panels – A, B, and C. The records of students' completion in the EBH assignments were compiled and analyzed to determine individual student's level of participation. Students who completed all EBH assignments in the course were recorded as having 100% participation and the participation of those who did not complete the assignments were awarded the level of participation proportionately. Additionally, the mean score of the four tests administered in the course was calculated for each student.

Panel A provides descriptive statistics of participation and non-participation in EBH for all students (OVERALL), as well as strong students (STRONG) and weak students (WEAK) groups.

Table 1: Descriptive Statistics

Panel 1: Descriptive Statistics for Students' Participation in EBH

	OVERALL	STRONG	WEAK
All Records	N = 297	N = 157	N = 140
	74.89	82.97	65.84
	[30.29]	[24.18]	[33.77]
EBH	N = 287	N = 154	N = 133
	77.50	84.59	69.30
	[27.32]*	[21.41]	[30.99]
Non-EBH	N = 10	N = 3	N = 7
	0.00	0.00	0.00
	[0.00]	[0.00]	[0.00]

Panel 2: Descriptive Statistics for Students' Course Mean Test Scores:

All Records	N = 297	N = 157	N = 140

	63.16	70.35	55.10
	[17.30]	[14.30]	[16.85]
EBH	N = 287	N = 154	
N = 133			
	63.53	70.44	55.54
	[17.06]	[14.26]	[16.59]
Non-EBH	N = 10	N = 3	N = 7
	52.50	66.00	46.71
	[21.51]	[19.47]	[20.91]
Panel 3: Descriptive Statistics for Students' Collegiate GPA:			
All Records	N = 297	N = 157	
N = 140			
	2.802	3.287	2.258
	[0.65]	[0.36]	[0.45]
EBH	N = 287	N = 154	
N = 133			
	2.821	3.292	2.275
	[0.64]	[0.36]	[0.43]
Non-EBH	N = 10	N = 3	N = 7
	2.278	3.054	1.945
	[0.79]	[0.21]	[0.71]

*** Numbers on brackets represent standard deviation.**

The overall mean level of participation for all students of 74.89 was lower than the strong students' mean of 82.97 and weak students mean of 65.84. The mean levels of participation for participating students (EBH) followed the same pattern, with the means of 77.50, 84.59 and 69.30 for OVERALL, STRONG and WEAK respectively.

Panel B presents descriptive statistics of the mean test scores (student performance) on the basis of participating (EBH) and non-participating (non-EBH) students. The mean test score of 63.16%, for

OVERALL was lower than the mean of 70.435 for STRONG and higher than 55.10% for WEAK. Similarly, statistics for the mean test scores for EBH and non-EBH participants followed the same pattern where the mean scores for STRONG and WEAK were higher and lower than the OVERALL mean score respectively.

Panel C shows the descriptive statistics of the students' collegiate GPA. The mean GPA for all students (OVERALL) was 2.802, and 3.284 and 2.255 for STRONG and WEAK respectively. Mean GPA for EBH were 2.821, 3,289, and 2.271 for all EBH students, STRONG, and WEAK groups respectively. For non-EBH students, mean GPAs were 2.78, 3.054, and 1.945 for all non-EBH students (OVERALL), STRONG, and WEAK groups respectively.

The first hypothesis (H1) predicts that the level of student participation in EBH will have a direct relationship with students' performance. To determine the relationship between student performance and EBH, we conducted a regression analysis which provided a model that revealed a direct relationship between the EBH level of participation on student performance. The regression statistics for the model is presented in Figure 1. The result of the analysis produced the following regression model:

Mean Tests Score = 40.23 + .3006EBH

The regression model indicated that there was a correlation between EBH participation and student performance.

Figure 1: Regression Statistics

Regression Statistics	
Multiple R	0.481433863
R Square	0.231778564
Adjusted R Square	0.22908305
Standard Error	14.98140929
Observations	287

ANOVA

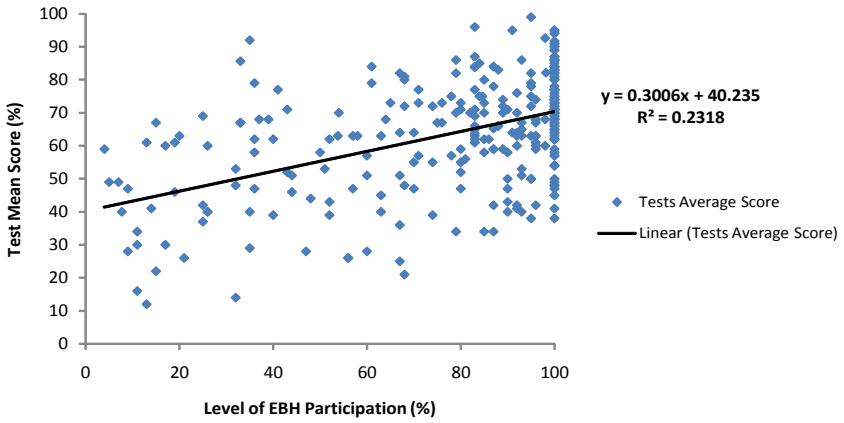
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	19299.09947	19299.09947	85.98678411	4.66161E-18
Residual	285	63966.1479	224.4426242		
Total	286	83265.24737			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	40.23474166	2.66371021	15.10477435	2.84017E-38	34.99170081	45.47778251
EBH Scores	0.300626667	0.032419898	9.272905915	4.66161E-18	0.23681385	0.364439484

The p-value of zero shows that the relationship between EBH participation level and mean test score was significant. At 95%, the confidence interval for the coefficient was [0.2368, 0.3644], which means that the population mean was within the interval. The fact that the interval did not include zero is a further indication that there was a significant relationship between the EBH participation level and mean test score, meaning that a 10% increase in the level of EBH participation led to a 3.0% increase in the mean test score. The R-squared of 23.17 shows that EBH utilization explains 23% of the variability in the mean test score. The scatter plot of the mean tests scores and the EBH levels of participation is shown in Figure 2.

Figure 2: A Scatter Plot of the Mean Test Score versus EBH

Utilization and Regression Line



The results of the regression analysis support H1 that student participation in EBH has a positive influence on student performance in the introductory accounting course.

The second hypothesis (H2) predicts that the influence of EBH participation on student performance is significantly different between strong and weak student groups. To test the hypothesis, we performed the analysis of variance (ANOVA) and analysis of covariance (ANCOVA).

The ANOVA statistics result with a p-value of zero indicates that there was a significant difference between the mean test score of strong participating students and that of the weak participating students. The result of the analysis of variance is presented in Figure 3.

Figure 3: ANOVA Statistics

Anova: Single Factor - Dependent Variable

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
STRONG	154	10847.13	70.43590909	203.228623
WEAK	133	7387.17	55.54263158	275.3153665

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	15829.63966	1	15829.63966	66.90007636	9.52888E-15	3.874293626
Within Groups	67435.6077	285	236.6161674			

The ANOVA statistics show a p-value of zero, which indicates that there was a significant difference between the mean score of the strong participating students and that of the weak participating students.

For further analysis to control for the impact of student aptitude/grade history, we used student's collegiate GPA as a proxy for aptitude/grade history factor. ANCOVA was completed. The results of the analysis are presented in Figure 4.

Figure 4: ANCOVA Statistics

ANCOVA

SUMMARY

ANCOVA

Groups	Count	Average
Y_{STRONG}	154	76.3179478
Y_{WEAK}	133	49.66059286

ANCOVA

Source of Variance	*SS*	*df*	*MS*	*F*	*P-Value*
Between Groups	14592.49	1	14592.49	90.86795	6.05974E-19
Within Groups	47213.48	294	160.5867		
Total	61805.97	295			

The p-value value of zero indicates that there was a significant difference in performance (mean test score) for either STRONG or WEAK group after the effect of aptitude/grade history factor (GPA) was removed. The results of the ANOVA and ANCOVA support H2 indicating that the performances of STRONG and WEAK participating students were influence differently.

In determining the influence of the efforts/motivation factor on student performance, we calculated the mean test scores of the STRONG and WEAK groups of the participating students to those of the STRONG and WEAK groups of non-participating students to determine if EBH made a difference in performance. The mean scores of both STRONG and WEAK participating students were higher than the mean scores of the STRONG and WEAK non-participating students.[2] The results are presented in Table 2.

Table 2: Mean Scores for Participating and Non-Participating Students

Mean Scores		
	EBH	non-EBH
STRONG	70.44	55.54
WEAK	66.00	47.00

An observation of the results reveals that the mean scores of the strong and weak participating students of 70.44 and 66.00 respectively were higher than the mean scores of the strong and weak non-participating students of 55.54 and 47.00 respectively. Therefore, we cautiously conclude that EBH did positively influence student performance. Hence, H3 is supported.

[2] Due to the disproportionate number of students between EBH and non-EBH groups, caution should be exercised in extending the result.

CONCLUSION

The results of the study answer the research question of whether the utilization of EBH impacts student performance in an introductory accounting course. The results indicate that there was a strong and positive correlation between the level of EBH participation and students' achievement on tests in the principles of accounting courses. Accordingly, the use of EBH assignments can be an effective tool in learning and understanding the fundamentals of accounting. In addition to the analysis of the data, we asked for student's feedback on the use of EBH assignments in the course. A summary of the students' comments are presented below:

Students Appreciated:

1. the instant feedback when doing the homework assignments
2. the opportunity to rework the homework exercises as many times as needed to get the correct answers or master the relevant concepts of the course material
3. ability to do the homework assignments at their convenience – EBH was available "24/7."
4. reward for doing the homework (points counting toward the overall course grade) was an incentive
5. homework assignments complement the materials covered in class, as well as the and in-class assignments

Students Complained:

1. that the EBH was time-consuming
2. about the woes of operating in a simulated environment (i.e. correct answers were marked as incorrect because answers were not presented exactly as simulated)

These comments provide insights to instructors on the value of EBH as an effective teaching and learning tool, and will serve to guide instructors in finding the best way to ensure the effectiveness of the resource in enhancing student learning. Additionally, using EBH in accounting classes provides the instructor with more time for classroom instruction that would otherwise not be available if paper-based homework (PBH) system is used. Similarly, the instructor does not spend as much time grading paper-based homework, which gives the instructor more time to prepare and plan for the teaching of the course.

This study reveals that the use of EBH system in entry-level accounting courses is appropriate, and it can be effective in enhancing learning. As a by-product, it encourages and develops active self-learning.

Limitation

The main focus of this study is to determine the impact of the EBH utilization on students' performance. Although aptitude/grade history and motivation factors were considered in this study; it is conceivable that students' personal characteristics and environmental factors addressed by Wooten's Model of Student Performance (1998) could influence on student performance. Because these factors were beyond the scope of this study, the results of this study should be interpreted with caution.

Suggested Future Study

The EBH system is a relatively new phenomenon in accounting pedagogy. Hence, there is more to be learned. One area of opportunity for research is to compare the effectiveness of electronic-based homework system to that of the paper-based homework system in accounting. Another further research effort can be expended on determining the impact of students' personal and environmental factors on electronic-based learning.

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