Evaluating the Effectiveness of Using Computer Tutorials to Teach Basic Accounting

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Abstract

This article addresses the effectiveness of teaching engineering students basic accounting using computer –based tutorials versus traditional methods. In a previous study the authors surveyed 147 engineering students to address the issue. The purpose of this study is to test their model on a larger sample of students from a wider cross section of years. By studying the topic over a larger time continuum, validation of the earlier research was attempted with the hope of developing more robust and generalizable conclusions and recommendations. This continued research was conducted to evaluate the gain in a student's knowledge of basic accounting via a set of pre- and post-tests. The study compared student's test scores using computer-mediated accounting tutorials with those of students who received traditional lectures and computer assistance in the same topic. All students sampled were undergraduate engineering students taking a required Engineering Economy core course that contained accounting computer tutorials. It was anticipated that both processes would be satisfactory instructional methods and yield similar educational results.

The results of the research confirmed that there is no statistically significant difference between the two methods. This study concludes that computer based tutorials are effective in teaching basic accounting. In addition, the student use of computer-mediated tutorials in a lab context could be substituted for traditional lectures with an instructor without impacting what a student learns - at least for teaching engineering cost accounting fundamentals.

Background

Integrating computer use into the classroom is an increasingly common occurrence (Keown, 1999; McLester, 2001). But does such integration produce students as knowledgeable in a subject matter as the traditional lecture format? Holman (2000) contends that matching a student's individual learning style to the teaching resource could have important implications in a students' learning. In addition, Pitman, Gosper and Rich (1999) report that students use different course materials in different ways and to different degrees. Implementing supplemental teaching methods such as computer tutorials into the classroom may thus assist the students in achieving even more knowledge than the traditional lecture formats.

This study was set up to explore the impact of different methods in the teaching of accounting. Specifically, computer-mediated tutorials were compared with traditional lecture instruction to determine if they were equivalent educational methods. To accomplish this, two groups of students were examined: those who had never taken an accounting course vs. those who already took a traditional accounting course. Both groups of students went through the computer-mediated tutorials on aspects of accounting used in Engineering Economy. (Note that the accounting subject matter was only covered in the computer tutorials and was not covered in lecture format in the Engineering Economy class. The accounting materials taught in the tutorials would be necessary to complete future problems in the course.)

The purpose of this study was to extend existing theory on computer-mediated learning and to investigate the impact of additional longer-term data collection on the currently used computer tutorials. The guiding hypothesis of this research was that singular and supplemental forms of computer tutorials would be just as successful at teaching the accounting skills needed for Engineering Economy and yield similar results. To explore this hypothesis, the following population was used and study performed.

Computer Tutorials and Population

Before testing the computer tutorials, the tutorials were initially pre-tested with several groups of students over the summer and fall of 2000. Comments and suggestions for improvement were collected, considered and the tutorials were modified and improved accordingly. The upgraded tutorials were then pilot tested with one hundred and forty seven, fourth and fifth year engineering students in the spring of 2001. This pilot test indicated the computer tutorials were effective (See Merino and Abel 2002), so the authors augmented the sample by adding approximately 325 additional fourth and fifth year students who participated in the spring, summer and fall of 2002. This gave a total population of 474 possible responses. All students were enrolled in an Engineering Economy class that is a required core course for all Stevens Institute of Technology engineering students, regardless of discipline. All tests were distributed in the lab in paper format. Pre-tests were distributed and collected at the start of class, before the lab had begun. And post-tests were distributed and collected approximately three hours later after each lab was completed before the student left the class. All tests were completed by those students who attended the lab, and were returned to the professor immediately upon completion.

An important reason for using students from Stevens is that all students are required to own computers upon entrance to college in their freshmen year. Thus, all Stevens' students could be considered to be computer fluent by the start of their junior or senior years. This factor is important since differences in pre-existing computer knowledge or fluency were not considered a factor in this particular study. However, such pre-existing knowledge, if not controlled, could have influenced research such as this.

The Study

On the first day of the lab portion of the Engineering Economy course a general survey was administered to all students in the class. The purpose of this first survey, although not made

obvious to the student, was to differentiate two distinct groups in the class, which were distinguished by whether or not the students had previously taken the Engineering Cost Accounting Course – a traditionally taught class at Stevens. The sample rendered an N of 59 to 81 for those students who previously took the traditional course, and an N of 225 to 336 for those students who only took the computer tutorials. Numbers differ per computer tutorial as non-valid pre- and/or post-tests were collected but not used. (Non-valid tests would be those for which there was only a pre-test or only a post-test for a student for a specified tutorial, but not both.)

It was hypothesized that those students who only used the computer tutorial would not have a significant difference in post-test scores from those students who took the traditionally taught class and computer tutorial. In essence those students who previously took the traditionally taught accounting class would have no additional effect from the computer-mediated learning. Or in other words, in the singular form, computer tutorials are expected to be adequate tutors, but in a combined form with traditionally taught course, computer tutorials are simply a supplement, not an addition. Please see Table 1 for an outline of expected results.

Table 1 – Hypothesized Results

	Group X – Students who..	**Group Y – Students who..**
	previously Took the traditional course	**did NOT Take the traditional course**
Pre-test	X1 – High	Y1 - Low
Post-test	X2 – High	Y2 - High

Note: No significant difference expected between X2 and Y2

All students were randomly assigned to class sections by the Registrar's office at Stevens. Regardless of section or year, all students took the same three computer tutorials (A, B and C) over a one semester time period. Prior to each tutorial, before any instruction began, every student took a pre-test. The purpose of each pre-test was to assess the student's pre-existing accounting knowledge in a particular area prior to performing the computer tutorial in that area (A, B, and C). The post-tests were administered after the completion of each tutorial and were used to assess how much the student had learned from each computer tutorial (A, B and C) beyond which they came to class (i.e. their pre-test score). Both pre and post test were similar.

Data Analysis and Results

Hypothesis – Will those students who previously took the lecture format course and the computer tutorial score similarly on the Post- Tests to those students who just took the computer tutorial alone.

NULL HYPOTHESIS/STATISTICAL TESTS

Null hypothesis H (0) - No difference in mean test scores between conditions (X2=Y2)
Two-tailed T-test (95% confidence limit)

The null hypothesis was that there is no difference between the means of the two post-tests (X2 and Y2). Or in other words, the methods of instruction are equally effective in teaching the subject. To analyze the data, a t-test was used on the post-test measures. The frequencies of the data are shown in tabular form in the Appendix. Please refer to the Appendix to view how the data strongly matched the hypothesized trends outlined in Table 1 earlier. Table 2 below summarizes the results of the statistical analysis.

Table 2 – Statistical Results

	t	Degrees of freedom	Significance	Effect Size+
Post-test A	2.930	421	.004#	.357
Post-test B	-1.765	395	.078*	.220
Post-test C	-.469	309	.640*	-.068

significant, $p < .05$
* not significant, $p > .05$
+ Effect sizes are calculated by taking the difference between means for the two groups and dividing by the standard deviation for the total sample.

As can be seen from the data above, only one of the tests was significant and showed a difference in post-test scores for the two methods – lecturing and computer tutorials versus computer tutorials alone. The one significant test was for Tutorial A; where Group X (lecturing plus computer tutorial) scored significantly higher than Group Y (computer tutorial alone). Refer to the Appendix for details. The authors feel this could be easily explained by the supplemental lecturing the students received in Group X. However, it bears mentioning that Group Y – only computer tutorial students – were still able to score an average of approximately 81% - a more than adequate passing grade. The remaining Tutorials B and C, as denoted above, showed no significant difference between Post-test measures indicating that a statistical difference between the two instructional methods could not be found. Although one can never "prove" the null hypothesis – no difference between methods – for non-significant results, having small effect sizes is additional evidence that there is no meaningful difference between groups. Further, the effect sizes were both positive and negative, which is also an indicator of no meaningful differences between groups. Lastly it should be noted that the sample was relatively large. N approaches infinity after 120 subjects (i.e. the t value does not vary) and there is good statistical power. As such, there is limited evidence from this study of a difference between instructional methods. Computer tutorials alone appear to be just as adequate an instructional method as traditional lecturing supplemented by computer tutorials. These findings are consistent with past research completed by Merino and Abel (2002), Holman (2000) and McNaught, et.al. (1995) as well as others.

Conclusions

Many universities and colleges are supplementing assignments and other course activities with technology-based lessons (Wallace and Mutooni 1997). But do these technology-based lessons actually improve student performance or are they simply like any other supplemental instructional material?

The use of one such technology – computer tutorials – and its impact on student learning was explored in the process of performing this research. The consensus at this point is that computer tutorials can be used as a singular form of instruction or as a supplemental form of instruction in conjunction with traditional lecturing (Sweeney and Ingram 2001). The results of this research agree; the analysis on post-test scores showed limited evidence as to differences in methods. Thus, both the singular and the supplemental forms of computer tutorials were just as successful at teaching the engineering cost accounting skills used in Engineering Economy. These conclusions imply that students achieve similar scores whether they are taught via computer-mediated learning alone or whether it is used in combination with traditional classroom instruction.

Implications

The outcome of this research is in keeping with the results found by Coe and Elliot (1999) who reported that grade outcomes for learners via computer were quite similar to those of on campus learners. Holman (2000) also found that there was no significant difference in post-test scores between students who were taught in a classroom setting and those who were taught by computer tutorial. These studies point to the conclusion that instruction delivered by computer is a viable educational option and supports the initial claim by the authors in Merino and Abel (2002).

To instruct more effectively in todays technologically savvy environment, or simply to stay with the times, colleges or instructors may continue to incorporate computers into their classrooms. Although, this may "bring the classroom into the 21st century" in appearance, the amount of knowledge transferred to the student, appears to remain the same as that relayed using the age old lecture format. However, the students in this study were only partially educated in a 'computer as an integral learning tool' world. As our students become 21st century graduates and gain their entire educations in the 21st century, will traditional lecturing remain neck and neck with the computer in imparting knowledge? Or as students have computers integrated into their educations at every level – grade school through college – will one method win out? This question merits a return to this type of study as our educational systems become more and more technologically integrated.

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Appendix

Table – Results of Tutorial A

		Group X	**Group Y**
Test		**Took traditional course**	**Did NOT take traditional course**
Pre – A	Mean	.5647	.4419
	Std. Dev.	.2763	.2839
	Std. Error	.0323	.0164
Post – A	Mean	.8686	.8077
	Std. Dev.	.1342	.1711
	Std. Error	.0153	.0092

Table – Results of Tutorial B

		Group X	**Group Y**
Test		**Took traditional course**	**Did NOT take traditional course**
Pre - B	Mean	.4421	.3350
	Std. Dev.	.2713	.2768
	Std. Error	.0311	.0158
Post – B	Mean	.8556	.8894
	Std. Dev.	.1676	.1496
	Std. Error	.0186	.0084

Table – Results of Tutorial C

		Group X	**Group Y**
Test		**Took traditional course**	**Did NOT take traditional course**
Pre - C	Mean	.3812	.2750
	Std. Dev.	.2373	.2226
	Std. Error	.0309	.0148
Post - C	Mean	.9230	.9309
	Std. Dev.	.1434	.1373
	Std. Error	.0185	.0086

Biographical Information

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Donald Merino is the Alexander Crombie Humphreys Chair of Economics of Engineering and a tenured full professor of Engineering and Technology Management at Stevens Institute of Technology. He teaches Engineering Economy, Decision Analysis, Total Quality Management, and Strategic Planning. He is the founder and Program Director of the Executive Master in Technology Management (EMTM) Program. He was founder of the undergraduate Bachelor of Engineering in Engineering Management (BEEM) at Stevens. He won the Morton Distinguished Teaching Award for full professors at Stevens. John Wiley published his book, "The Selection Process for Capital Projects". Dr. Merino received two Centennial certificates from the ASEE in Engineering Economics and Engineering Management. He is past Chair of the Engineering Management Division and Engineering Economy Division of ASEE.

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