2006-146: MODERNIZING TEACHING METHODS IN THE CLASSROOM – DOES IT IMPACT STUDENT PERFORMANCE?

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Modernizing Teaching Methods in the Classroom – Does it Impact Student Performance?

Abstract

Does the use of technology in a typical classroom setting build a more effective educational method that truly assists students to learn more and do better in class? This is the research question addressed in this paper.

To study this, a Statistics for Engineering Managers course was analyzed. The course was required for all junior Engineering Management students at Stevens Institute of Technology. Traditionally, the course was taught via a whiteboard and marker. In 2002, the course was modified and all notes traditionally provided on the board, were transferred to Powerpoint slides. The purpose was to change the focus for the student, from note taking, to the digestion of presented material. In essence, the purpose was to allow the students to concentrate on understanding the material, rather than copying it down before it was erased from the board.

Final grades over the course of several semesters were compared via a regression analysis. Data were not analyzed until the end of the fourth semester to eliminate grading prejudice in the study. Analyses demonstrated that students who were provided the same material via Powerpoint slides achieved higher grades than those who were provided the material via white board.

Lessons learned from this research could impact the possible restructuring of classes, including traditionally math based, whiteboard, courses such as Statistics, since the results from this research indicate that those students that are provided Powerpoint notes do significantly better than those that do not.

Background

A range of issues contribute to the success of learning and teaching with technology (Alexander 2001). Just as there are various methods used to teach in the classroom, there are also various methods students use to solve problems in the classroom. Pitman, Gosper and Rich (1999) report that different students use different course related materials (paper vs. computer) in differing ways and to different degrees. Thus, the use of varied teaching resources is very important in order to match individual student learning styles and could have important implications for future educational programs and curriculum contents (Holman 2000).

Authors, such as Wallace and Mutooni (1997), concur with results that students participating in web based instruction perform better than those receiving traditional classroom instruction. They stated that such teaching methods could provide more effective and economical engineering education. In addition, they concurred with the

theme of this article that providing different teaching methods will accommodate the different learning modes and styles of students. Gunasekaran, et.al. (2002) agree when they state that e-learning students performed better and has many advantages including convenience to users, easy accessibility as well as consistency and repeatability.

This study was set up to determine if instructing a statistics course for engineers via computer was as effective a method of teaching as a classically taught college statistics course using a whiteboard. To accomplish this, two groups of students were examined: those who took a traditionally taught statistics course vs. those who took a statistics course taught via Powerpoint slides and WebCT postings. Both groups of students went through very similar first-semester junior level statistics material.

The goal of this study was to evaluate whether students who were provided with Powerpoint slides and access to material via WebCT would do better than those students who took the traditionally instructed statistics course. The assumption is that those students receiving instruction via Powerpoint slides and WebCT will score significantly higher than those who received traditional course instruction.

The author believes that the computer-aided Powerpoint instruction will be just as successful in teaching statistics to college engineering students as the classical instruction course. This is comparable to the results found by Merino and Abel (2002) and McNaught, et al. (1995).

Population and the Study

Statistics for Engineering Managers is a 3-0-3 credit course that has been taught at Stevens Institute of Technology for many fall semesters in a row by only three instructors. This Statistics for Engineering Managers class is a required core course for all Stevens' Engineering Management students. Although the material, homework and tests, etc were not exactly the same, due to restrictions by the college of administering the exact same assignments at different times (which might promote cheating), it could be said that equivalent material (identical text, the same instructional material, similar test material, etc) were instructed and evaluated throughout the various semesters.

Data on the Statistics for Engineering Managers class was collected on teaching methods and final grades for a total of four successive semesters between Fall 2000 and Fall 2003. Thirty-seven students were taught via traditional instruction in Fall 2000 and twenty-seven were taught via computer-aided Powerpoint instruction and access to electronic documents via WebCT in the succeeding fall semesters.

As this statistics class was only offered as one section, once a year, students did not have an option of selecting their teaching method. The transition to computerized instruction simply occurred in the Fall of 2001. Also note all students are required to take the statistics course in their junior year. Thus, there can be no self-selection occurring on the part of the student, nor selection on the part of the instructor as to who took which

instructional method in their statistics class. Lastly, since all students must take the statistics class in their junior year, there should be no outlying deviation in average GPA of individual students, not already due to naturally existing circumstances in each junior class.

Adding the numbers of students above from the Fall 2000 to Fall 2003, a total of 63 data points were gathered and analyzed for this study. This is a moderately large sample size. Since N jumps from 60 to 120 subjects and then to infinity (i.e. the t value does not vary much between 60 and infinity) there was good statistical power in this study.

It should also be noted that all students at Stevens 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 this course in their junior year. As such, differences in pre-existing computer knowledge or fluency were not considered a factor influencing the results of this study.

Hypothesis

It was hypothesized that use of computer-aided teaching tools in the classroom, such as Powerpoint, would impact students' final grade. This is based on the premise that computer aided instruction provides assistance beyond the classroom. Thus, it was hypothesized that those students who took the computer-aided Powerpoint instructed class would have a significant difference in final grade from those students who were instructed in a traditional whiteboard method.

Hypothesis – Those students who took the computer-aided, powerpoint instructed class will score higher in their final grades than those students who were instructed in a traditional whiteboard method.

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

Table 1 – Hypothesized Results

	Group X – Students who..	**Group Y – Students who..**
	took the <u>computer-aided</u> course	**took the <u>traditionally instructed</u> course**
Final Grade	X – Higher Final Grade	Y – Lower Final Grade

Results of Data Analysis

The null hypothesis is that there is no difference between the final grades for the two methods (X and Y); i.e. both methods are equally effective in teaching the subject. To test this, a linear regression was performed. The dependant variable was final grade. And whether the students used computer-aided technology such as Powerpoint and WebCT was the independent variable. See Table 2a and 2b – Results, to view the

detailed data and how it strongly matched the hypothesized trends outlined in Table 1 above. The statistical results showed significance with $t = 2.183$ and $p < .033$.

Table 2a – Actual Results

	Group X – Students who..	**Group Y – Students who..**
	Took the <u>computer-aided</u> course	**Took the <u>traditionally instructed</u> course**
Final Grade	X – 2.937	Y – 2.252

Table 2b - ANOVA[b] Results

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig**
Regression	7.909	1	7.909	6.101	.016[a]
Residual	80.373	62	1.296		
Total	88.281	63			

a: Predictors: (Constant) : use of powerpoint: note significance at the $p < .05$ level
b: Dependant Variable : Grade

As can be seen from the results in Tables 2a and 2b, a significant difference existed in the final grades between those students participating in the computer-aided, Powerpoint instructional method statistics classes and those in the traditional instruction method classes. Thus, those students who received the computer-aided instruction did have a statistically significant higher final grade than those who had the traditional method of instruction. This indicates that the computer-aided method of instruction was successful at conveying the concepts of Statistics for Engineering Managers to undergraduate engineering students.

Implications and Future Research

Today, many campuses are incorporating technology into some aspect of their teaching environments (Keown, 1999; McLester, 2001). Interesting points on the impact of such technology in the classroom were raised in the process of performing this research. The consensus thus far is that computer assisted learning can be used in combination with the traditional classroom experience (Sweeney and Ingram 2001) to further learning. This outcome is in keeping with those results found by Holman (2000) who found that those students who were taught in a classroom setting showed no significant difference in post-test scores from those who were taught by computer tutorial. The results of this research concur, indicating that using computer aided instruction such as Powerpoint, does not hinder, and may only help, students achieve higher grades.

One question that is brought to mind with an investigation such as this, is what is the applicability of this type of computer instruction to other engineering courses. The author hypothesizes that classes where material with complex underlying theory is written across the board constantly would be the best classes in which to use Powerpoint instruction. The theory is that by providing computer slides to students with the many

mathematical examples that are going to be covered in class that day, a student can change his focus from copying down examples before they are erased, to understanding the underlying concepts behind the examples themselves. In this way the student's focus is shifted from copying to comprehension, thus potentially improving a student's overall understanding of the subject and reducing his tendency to simply "plug and chug". More research is necessary before these questions can be thoroughly answered.

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