Do PowerPoint Presentations Really Work?

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Abstract

The use of PowerPoint presentations to enhance lectures and improve learning is discussed in this paper. PowerPoint presentations were used throughout the semester in a required undergraduate course in Environmental Engineering at Mercer University to enhance student interest and hopefully improve student performance. Handouts of the PowerPoint slides were given to each student at the beginning of each class. Statistical analysis using the analysis of variance (ANOVA) was performed on student's final grades when the course was taught in a traditional lecture format versus using the PowerPoint presentations for comparison. The use of PowerPoint presentations did not enhance overall student grades compared to the traditional lecture format.

I. Introduction

In recent years, the public, industry, and legislatures have increasingly scrutinized the university educational systems. The United States Accreditation Board Engineering and Technology (ABET) has established engineering Criteria 2000 for to make engineering schools accountable for improving communication skills, teaming skills, lifelong learning skills, and awareness of global and societal issues. In addition to those skills, engineering graduates must have a firm knowledge of math, science, and engineering fundamentals. The primary impetus for this change was to improve the overall quality of engineering education. Felder and Brent[1] discussed this reformation in higher education. They suggested that it will take more than faculty development to have a lasting reform and that administrators must modify the faculty incentive and reward system by making educational scholarship and disciplinary scholarship comparable in the promotion and tenure process.

The use of multimedia presentations and the Internet has been heralded as one method to enhance learning. Christensen and Barrett[2] described how the Internet was used to distribute a full range of course materials to enhance off-campus education at the University of South Florida. The use of computers and commercially available software was discussed by Ferguson[3] to increase understanding and supplement lectures. Juriasingani et al.[4] reported on the use of CD-ROM PowerPoint based presentations to illustrate the installation of sewers and water mains. The authors reported that students

enjoyed the computer based visual learning, however, no formal assessment of the presentations was offered. Slivinsky[5] discussed the use of PowerPoint presentations to teach Circuits I at the University of Missouri-Columbia. An example questionnaire to assess the course was provided in the paper; unfortunately, a thorough assessment of the value of the techniques used had not been undertaken. Buchanan and Coowar[6] promoted the use of PowerPoint software to enhance lectures. They primarily discussed the mechanics of preparing PowerPoint slides and did not assess the use of the software. Jack[7] presented a workshop that covered successful methods of using high tech systems for making classroom and conference presentations. He suggested several techniques for a successful presentation along with a list of the top ten mistakes made.

Although multimedia and innovative teaching methods are being promoted to enhance learning, some proponents still favor the traditional lecture. Barger et al.[8] reviewed the characteristics of good information transfer procedure and showed how the traditional lecture meets those requirements.

Some state university systems such as the state of Florida have instituted a Teaching Improvement Program (TIP) to enhance the quality of teaching, primarily at the undergraduate level. Recipients of this award receive an additional $5,000 to their base salary as long as they remain employed in the State University System[9]. The author received such an award while at the University of South Florida. Throughout his teaching career, he has tried a variety of techniques to enhance and improve learning in engineering education. This paper discusses the author's latest attempt to improve student learning by using PowerPoint presentations in a required undergraduate environmental engineering course at Mercer University in Macon, Georgia. Statistical analyses using the analysis of variance was performed on student's final grades when the course was taught in a traditional lecture format versus using the PowerPoint presentations for comparison. Overall course grades, design project grades, and final exam grades were compared.

II. Methodology

Statistical analyses employing the analysis of variance (ANOVA) test at the 95% confidence level were performed on student's grades on projects, final exams, and final grades to assess if the PowerPoint presentations enhanced student performance. ANOVAs were performed comparing the performance of students in the three areas above for three course offerings of EVE 405 "Water and Wastewater Treatment". EVE 405 is a junior/senior level undergraduate course required of all environmental engineering majors that provides in-depth instruction on the application of water quality data to the selection and design of unit operations and unit processes employed in potable water treatment facilities and municipal wastewater treatment facilities. The course has been offered three times: fall 1998, fall 1999, and spring 2000. For each course offering, students are required to design either a water or wastewater treatment plant as a team project. In addition to the design project, there are a variety of assignments to teach around the cycle[10]. A technical report must be prepared explaining the design project. Students are required to make a formal presentation on some topic related to process

design. Impromptu presentations are required of students to present homework problems on the board. In-class collaborative assignments, involving two or more students, takes place at least twice a semester for building team skills and encouraging working together.

The course was first offered during the fall semester 1998, and was taught in the traditional lecture format using the chalkboard. Eleven students were enrolled in the course during the 1998 fall semester. During the 1999 fall semester and 2000-spring semester, PowerPoint presentations were used rather than the traditional classroom lecture using the chalkboard. For the 1999 fall semester, six students were enrolled in the class, whereas, ten students were enrolled during the 2000 spring semester. Subjective experiences of the students were also compiled and are presented below.

III. Results and Discussion

The results of the statistical analyses are presented in Tables 1, 2, and 3. Table 1 shows the results of the analysis of variance (ANOVA) performed on the final exam grades. There was no significant difference between the final exam grades for the three course offerings since the Fisher value of 2.59 was less than the critical Fisher value of 3.40 for two degrees of freedom in the numerator and twenty-four degrees of freedom in the denominator. PowerPoint presentations did not seem to affect the final exam grades.

Table 1. Analysis of Variance of Final Exams

F	$F_{critical}$	df	α
2.59	3.40	2, 24	0.05

Table 2 presents the results of the analysis of variance performed on the design project grades. There was a significant difference between the design project grades for the three course offerings since the Fisher value of 6.60 was greater than the critical Fisher value of 3.40 for two degrees of freedom in the numerator and twenty-four degrees of freedom in the denominator. It appears that the PowerPoint presentations may have had a positive effect on the design project grades. The average student grade on the design project was 2.45, 2.83, and 3.70, respectively, for the 98, 99, and 00 offerings of EVE 405. The PowerPoint handouts contained design examples that lead to better project designs.

Table 2. Analysis of Variance of Design Project

F	$F_{critical}$	df	α
6.60	3.40	2, 24	0.05

Table 3 presents the results of the analysis of variance performed on the overall student grades. There was no significant difference between the overall student grades for the three course offerings since the Fisher value of 2.72 was less than the critical Fisher value of 3.40 for two degrees of freedom in the numerator and twenty-four degrees of freedom in the denominator. It appears that the PowerPoint presentations had no effect on the overall student grades. The average overall student grades were 2.64, 2.00, and 3.05, respectively, for the 98, 99, and 00 offerings of EVE 405.

Table 3. Analysis of Variance of Final Grades

F	$F_{critical}$	df	α
2.72	3.40	2, 24	0.05

Tables 4 and 5 present the major positive and negative comments of the students enrolled in EVE 405 during the 1999 fall semester and 2000-spring semester regarding the PowerPoint presentations. Overall, student comments recorded on teaching evaluations were positive about the PowerPoint presentations. They enjoyed the presentations but thought they were more appropriate for conveying general information and would be more beneficial for liberal arts types of courses.

Table 4. Positive Comments About PowerPoint Presentations.

1. Good for general information, especially when information is limited and recollection is not required.
2. I am able to follow along easier and comprehend with PowerPoint.
3. They are a great help in learning since we don't have to worry about writing all the notes down.
4. Dynamic presentations with sound and animation keep student's interests.
5. Easy for the presenter to use and cover a lot of material in a short time.
6. Lectures clearly outlined and readable.
7. Professor can print out handouts for the students to follow.

Table 5. Negative Comments About PowerPoint Presentations.

1. Not good for detailed information that must be learned and understood.
2. Harder to understand when the teacher is explaining a long derivation on many slides.
3. Teacher does a better job of explaining the material when writing on the board.
4. Not as easy to emphasize the most important points and understand when reviewing.
5. Students pay less attention during the lectures since they have handouts to rely on
6. When lights are dim during the presentations, students tend to get sleepy.
7. There is not as much interaction between professor and students.

IV. Summary and Conclusions

A statistical and subjective assessment of the use of PowerPoint presentations in an undergraduate environmental engineering course was undertaken. Student grades on final exams, design project, and overall final grades were compared to student grades when the course was taught in the traditional lecture type format. Based on the analysis of variance at the 95% confidence level, there was no significant difference in student grades on final exams and overall final grades. However, student performance on the design project appeared to be enhanced through the use of the PowerPoint presentation.

The general consensus of students taking the course was that PowerPoint presentations were good for discussing general information and not good for presenting detail engineering equations and derivations. Most students commented that they learned better from the traditional lecture format rather than from the PowerPoint presentations.

Major conclusions from this study:

- PowerPoint presentations did not result in overall higher final examination grades or course grades.
- PowerPoint presentations did appear to improve student grades for the design project.
- Students liked the PowerPoint presentations, however, they stated they learned more and understood complex material better when using the traditional lecture format because they learned and retained the material better as they copied the information from the board.
- Students were less attentive and there was less interaction between professor and students when the PowerPoint presentations were used.

References

1. Felder, R. M., & Brent, R. Faculty Development: Getting the Sermon Beyond the Chori, *Proceedings of the 1998 ASEE Annual Conference*, Seattle, WA (1998).

2. Christensen, K. & Barrett. A. Using the Internet to Enhance Off-Campus Engineering Education, *Proceedings of the 1997 ASEE Southeastern Section Conference*, Marietta, GA (1997).

3. Ferguson, G. Using Multi-media Resources for Demonstrating Engineering Science Concepts, *Proceedings of the 1997 ASEE Southeastern Section Conference*, Marietta, GA (1997).

4. Juriasingani, P., Robinson, R. B., & Fox, C.D. Installing Sewers and Water Mains: An Educational CD-ROM, *Proceedings of the 2000 ASEE Annual Conference*, St. Louis, MO (2000).

5. Slivinsky, C. Multimedia and Web Techniques for Teaching Circuits I, *Proceedings of the 2000 ASEE Annual Conference*, St. Louis, MO (2000).

6. Buchanan, W. W., & Coowar, R. Using PowerPoint Software to Enhance Your Engineering or Engineering Technology Lectures, *Proceedings of the 1995 ASEE Annual Conference,* Anaheim, CA (1995).

7. Jack, H. High Tech Presentations the Easy Way, *Proceedings of the 2000 ASEE Annual Conference,* St. Louis, MO (2000).

8. Barger, M., Engel, R., & Gilbert, R. How About A Good Lecture? *Proceedings of the 1996 ASEE Annual Conference,* Milwaukee, WI (1996).

9. Najafi, F. An Analysis of the Teaching Improvement Program at the University of Florida, *Proceedings of the 1997 ASEE Southeastern Section Conference,* Marietta, GA (1997).

10. Felder, R. Matters of Style, *ASEE Prism* (1996-1997).

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