Work in Progress - A Study of the Effect of Instructional Media in an Undergraduate Electrical Circuits Course

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Abstract - **Studies have demonstrated that instructional media play an important role in instructors' teaching and students' learning. The purpose of this study is to assess the students' preferences for different instructional media and the impact of different instructional media on the students' learning and course-related behavior in an undergraduate electrical circuit's course. The instructional media under study are: Computer-based PowerPoint presentation, whiteboard only, combination of PowerPoint and whiteboard and combination of printed handouts and whiteboard. In this study, nine sections of Introduction to Electrical Circuits sections were taught by 6 instructors using different instructional media. All the instructors used a common syllabus, labs, homework, and tests. Two midterm exams and one final exam were used to assess the learning effectiveness of different instructional media. At the end of the quarter, a questionnaire was collected from participating students to measure their preference for the instructional media. To understand the course related behavior, each of the instructors were asked to assess their students' behavior in terms of attendance, amount of classroom interaction, percent of homework completion and web logins.**

Index Terms – Instructional Media, PowerPoint, Students' learning

INTRODUCTION

In the last 15 years, PowerPoint has become more popular in college classrooms [1]-[4]. Many professors still prefer the traditional "chalk-and-talk" lectures. Although there has been much discussion concerning using PowerPoint in lectures [5]-[8], there is limited evidence to support the positive impact of a PowerPoint presentation on the student's learning, attitude and his/her course-related behavior (attendance, classroom participation and so on). Few studies exist to show the benefit of combining PowerPoint with traditional whiteboard lectures and reaping the benefit of both of them. One advantage of using PowerPoint is that it saves the students' time in taking notes so that the instructor can cover more material and examples in the class. An alternate way is to give the students printed handouts in class. This study will focus on the following four instructional media and assess the effectiveness of them:

1. Whiteboard only (The instructor uses the whiteboard mainly and doesn't use any multimedia equipment. No printed handouts are given for most of the lectures.)
2. Computer-based PowerPoint presentation only (The instructor gives PowerPoint presentations in lectures and rarely writes on whiteboard.)
3. Combination of PowerPoint and whiteboard. (The instructor uses PowerPoint for key concepts and principles but whiteboard for examples.)
4. Combination of printed handouts and whiteboard. (The instructor uses the whiteboard for examples and gives the students a copy of printed handouts which contains the basic principles and problem statements)

The study is expected to run for a total of two years and the final results will include data for more than 200 engineering students who completed the electrical circuits course.

PRELIMINARY RESULTS

The study was started in fall 2007. At the end of the quarter, 134 students completed a questionnaire which is used to measure their preference for the instructional media. The students were asked to rate their preference for each of the four instructional media based on their experience in the electrical circuits course as well as other courses which they are taking or have taken. 5 is the highest rating and 1 is the lowest rating. The result of the survey showed that students rank their preferred medium choice, in order of most preferred to least preferred as: Combination of printed handouts and whiteboard (average score: 4.15), Combination of PowerPoint and Whiteboard (average score: 3.87), Whiteboard only (average score: 3.23), and Computer-based PowerPoint presentation (average score: 1.91). FIGURE 1 shows the distribution of the students' rating scores. Among the four instructional media, the two combinational choices received better scores than either PowerPoint only or Whiteboard only.

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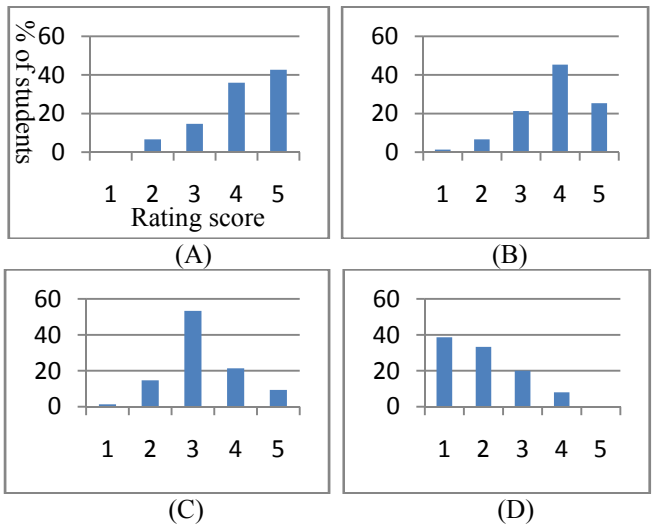

FIGURE 1
STUDENTS' RATING DISTRIBUTION OF (A) COMBINATION OF PRINTED HANDOUTS AND WHITEBOARD) , (B) COMBINATION OF POWERPOINT AND WHITEBOARD, (C) WHITEBOARD ONLY, AND (D) COMPUTER-BASED POWERPOINT PRESENTATION.

To understand why the students are in favor of a specific instructional media, the questionnaire also contains some items that assessed the students' attitudes towards the instructional media. Responses were on a 5-point scale, where 5 indicated strongly agree and 1 indicate strongly disagree. Table I shows five sample questions and the average scores of the students' responses. The survey results showed that the students like having a copy of the handouts and it makes their notes more organized.

TABLE I
SURVEY QUESTIONS AND THE AVERAGE SCORES

	Ratings
I think the use of PowerPoint is/(would be) helpful in increasing my learning in this electrical circuits course.	3.33
The use of PowerPoint does /(would) increase my interest in this course.	2.79
I think it is helpful if the instructor provides a hard copy of the presentation/handouts.	4.52
When I have a copy of the presentation, I am less likely to pay attention in class since I already have the material.	2.53
My notes were more organized when the professors gave a hard copy of the handouts.	4.04

Table II shows the average students' grade corresponding to different instructional media that is used by the instructor/s. Regardless of the students' preference, their grades on classroom assessments indicate that there was no significant difference in learning due to the type of instructional media used.

TABLE II
AVERAGE TEST SCORES

	Test1	Test2	Final
Whiteboard only	81.17	82.21	79.26
Computer-based PowerPoint presentation only	80.91	82.54	76.60
Combination of PowerPoint and whiteboard.	78.40	74.76	78.29
Combination of printed handouts and whiteboard.	79.05	78.37	76.86

FUTURE STUDY

The study will continue in the fall quarter of 2008 and similar data will be collected. In fall 2007, not enough data was collected to assess the impact of different instructional media on students' course-related behavior. In fall 2008, each of the instructors will be asked to keep track of the students' attendance, amount of classroom interaction, percent of homework completion and web logins. The data will be used to understand how the instructional media is related to students' course related behavior.

REFERENCES

[1] Karady, G.G.; Holbert, K.E., "Novel technique to improve power engineering education through computer-assisted interactive learning", *Power Systems, IEEE Transactions on*, Volume 19, Issue 1, Feb. 2004 Page(s):81 - 87

[2] Wolfe, C.; Alley, M.; Sheridan, K.C.; "Improving Retention of Information from Teaching SlideS", *Frontiers in Education Conference, 36th Annual*, 27-31 Oct. 2006 Page(s):17 – 21

[3] Dollar, A.; Steif, P.S., "New teaching and learning techniques facilitated by information technology", *Information Technology Based Higher Education and Training, 2004. Proceedings of the FIfth International Conference on*, Volume , Issue , 31 May-2 June 2004 Page(s): 449 – 454

[4] House, R.; Watt, A.; Williams, J.;, " Work in progress - what is PowerPoint? educating engineering students in its use and abuse", *Frontiers in Education, 2005. FIE '05. Proceedings 35th Annual Conference*, 19-22 Oct. 2005 Page(s):F3C - 15-16

[5] Deantonio, M.; Sandoval, L.M.; Arceo, R., "Work in Progress: A Quantitative Study of the Effectiveness of PowerPoint in the Classroom", *Frontiers in Education Conference, 36th Annual* Oct. 2006, Page(s):22 - 23

[6] Jennifer M. Apperson, Eric L. Laws and James A. Scepansky, "An assessment of student preferences for PowerPoint presentation structure in undergraduate courses", *Computers & Education*, In Press, Corrected Proof, Available online 13 June 2006,

[7] Jennifer M. Apperson, Eric L. Laws and James A. Scepansky, "The impact of presentation graphics on students' experience in the classroom", *Computers & Education*, Volume 47, Issue 1, August 2006, Pages 116-126

[8] Robert A. Bartsch and Kristi M. Cobern, " Effectiveness of PowerPoint presentations in lectures", *Computers & Education*, Volume 41, Issue 1, August 2003, Pages 77-86