Effective Uses of Technology-Assisted Instruction: An Investigation of Student Performance, Attendance, and Satisfaction

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Abstract

The usability of technology has put a new spin on education, redefining the role of educators and reshaping classroom learning experiences. A major movement today is the integration of technology into the classroom. Many universities, colleges, and community colleges are investing a great amount of money, effort, and training in developing innovative ways of using technology to increase student performance, learning, and satisfaction. This has resulted in the creation of multimedia classroom presentations, web-enhanced courses, online courses, and distance learning.

However, research investigating the effectiveness of technology-assisted instruction has resulted in mixed findings. Some studies have found that integrating technology into the classroom creates a rich, effective, and efficient learning environment which improves student performance and learning (see Cronin, Meadows, & Sinatra, 1990; Funkhouser, 1993; George & Sleeth, 1996; Luna & McKenzie, 1997; Sammons, 1995; Sherry, Jesse, & Billig, 2002; Traynor, 2003; Zack, 1995). However, some studies have not shown a benefit in student performance and learning as a result of technology integration (see Avila, Biner, Bink, & Dean, 1995; Branton & Lee, 2003; Garrett, 1995; Guy & Frisby, 1992). In light of this mixed data, it is clearly evident that more research should be conducted to determine appropriate and effective uses of technology in education.

When considering faculty workload, converting courses to multimedia presentations (e.g., PowerPoint) and web-enhanced courses (e.g., WebCT or BlackBoard.com) takes considerable time and effort. However, do these significant changes lead to improved student performance, learning, and satisfaction? The following study compared student performance, attendance, and satisfaction in General Psychology courses which were either technology-assisted using PowerPoint and WebCT or taught the traditional way using only a chalkboard. It may be the case that student performance will be better in the technology-assisted condition due to the rich learning environment. However, student performance in traditional condition may be better due to the activity of generating notes (i.e., the generation effect). Possible gender differences were also investigated.

Method

Participants
Participants were 417 General Psychology (PSY 101) students (261 females and 156 males) from Delta State University. A total of 215 students were in technology-assisted courses and a total of 202 students were in traditional chalkboard-taught courses. Since all Delta State University students are required to take General Psychology as a general education requirement, the participants consisted of students from various majors. Thus, even though the sample was not truly random, it was reasonability representative of Delta State University students.

Materials
Ten General Psychology courses consisting of approximately 40 students each were studied. Five courses were technology-assisted and five were traditionally-taught. All of the courses met on a Monday/Wednesday/Friday morning (i.e., 9:00am & 10:00am) schedule consisting of 50 minute sessions. The maximum allowed absences
for each course was 11 class meetings. Also, all ten courses were taught by the same professor using the same lecture material. The only difference was in how the material was presented.

In the technology-assisted courses, the PowerPoint presentations were organized in the same manner as the chalkboard lectures in the traditional courses. However, the PowerPoint presentations also contained digital photographs, tables, diagrams, movie clips, charts, and hyperlinks. Also, in the technology-assisted condition, students downloaded PowerPoint lecture outlines from WebCT before being presented with the course material via Microsoft PowerPoint with a lap-top and digital projector. Thus, students in the technology-assisted course were provided with complete lecture notes before receiving the lecture. This was done so that students could spend more time listening and comprehending the material rather than racing to write the notes before the next slide appeared. Students also used WebCT to check grades, review PowerPoint shows, access a wealth of information from various Internet links, participate in interactive demonstrations and simulations, and communicate with each other and the professor via electronic discussion boards and e-mail. In the traditional condition, the professor simply lectured and wrote notes on the chalkboard. Students in both course type conditions were given the same objective tests (i.e., four multiple-choice tests consisting of 50 questions each).

Design & Procedure
The design consisted of a 2 (course type: traditional/technology-assisted) X 2 (gender) between-participants design. The dependent variables were student performance (i.e., final grade averages) and attendance (i.e., number of days absent). Thus, student performance and attendance was measured as a function of course type and gender. College of Education teaching evaluations were also studied in order to gain quantitative and qualitative measures of student satisfaction. Teaching evaluations from General Psychology courses which were traditionally-taught were compared to those from technology-assisted courses. Students completed a 24-item questionnaire consisting of questions related to teacher performance, course content, and student satisfaction. Evaluation ratings were based on a 5-point scale in which “1” is a very negative rating and “5” is a very positive rating. The quantitative analysis was based on mean evaluations of the 24-item questionnaire obtained from students in traditional and technology-assisted courses.

Results
Student Performance
A 2 X 2 ANOVA yielded the following for student performance (i.e., final grade average): There were significant main effects for both course type (Traditional $M = 76\%$ & Technology-Assisted $M = 73\%$; $F(1, 413) = 6.28, p < .012$) and gender (Female $M = 76\%$; Male $M = 72\%$; $F(1, 413) = 8.90, p < .003$). The interaction between course type and gender was also significant, $F(1, 413) = 4.18, p < .041$. A Tukey HSD post hoc analysis yielded significant differences between the means.

Student Attendance
A 2 X 2 ANOVA for student attendance (i.e., mean number of days absent) indicated that the main effects for both course type (Traditional $M = 5.3$ & Technology-Assisted $M = 5.6$; $F(1, 413) = .73, p = .392$) and gender (Female $M = 5.3$ & Male $M = 5.6$; $F(1, 413) = .86, p = .352$) were not significant. Also, the interaction between course type and gender was not significant, $F(1, 413) = .92, p = .336$.

Student Satisfaction
Even though teaching evaluations were very high in both course type conditions (i.e., maximum rating is 5), a one-way ANOVA indicated significantly higher teaching evaluations in the technology-assisted courses ($M = 4.67$) than the traditional courses ($M = 4.52$), $F(1, 46) = 4.11, p < .048$. Also, qualitative data (i.e., student comments) obtained from the teaching evaluations indicated more positive comments in the technology-assisted courses than the traditional courses.
General Discussion

Interestingly, the results indicated that students did not benefit from technology-assisted instruction. Student performance was actually three percentage points lower in the technology-assisted condition ($M = 73\%$) than the traditional condition ($M = 76\%$). Also, regardless of course type, females ($M = 76\%$) scored higher than males ($M = 72\%$). Post hoc comparisons of means in the significant interaction indicated that female student performance was significantly lower in the technology-assisted condition ($M = 73\%$) than the traditional condition ($M = 79\%$). Whereas, male student performance in the technology-assisted condition ($M = 72\%$) and traditional condition ($M = 73\%$) did not significantly differ. Also, post hoc comparisons indicated that the significant interaction was the result of females performing much better in the traditional condition ($M = 79\%$) than students in all other conditions. It is important to note that, while male students’ performance did not benefit from a technology-rich learning environment, female students’ performance actually decreased.

Intuitively, one would think that technology-assisted instruction would lead to increased learning and understanding due to organization, availability of information, and visual graphics. This clearly did not happen. One reason for lower student performance in the technology-assisted condition may be the practice of allowing students to download complete PowerPoint lecture notes for use in class. However, this lack of note-taking may have negated a powerful memory phenomenon known as the generation effect. According to the generation effect, individuals demonstrate better memory for material they have generated themselves than for material they have merely read (Slamecka & Graf, 1978). The generation effect has also resulted in improved memory when individuals must complete or modify material (Lutz, Briggs, & Cain, 2003). The generation effect is a robust finding in memory research. It has been demonstrated using words, numbers, and problem-solving tasks (see Slamecka & Graf, 1978; Jacoby, 1978; Gardiner & Rowley, 1984; Marsh, Edelman, & Bower, 2001). From a levels-of-processing approach of semantic memory (see Craik & Lockhart, 1972; & Craik & Lockhart, 1975), the generation effect is thought to be due to the deeper processing required of words that are generated as opposed to words that are read. The deeper information is processed at encoding, the better it is remembered due to enhanced access to the memory item in the learner’s memory representation (Lutz, et al., 2003). Another explanation of the generation effect is based on the inherent differences in the two tasks (i.e., generating and reading). This explanation assumes that arousal may be heightened during generation as compared to during reading (Jacoby, 1978).

Thus, student performance may have been better in the traditional condition due to the generation activity of note-taking. That is, according to the generation effect the act of students taking notes leads to increased arousal and deeper processing of the information at encoding. This, in turn, resulted in better memory of the material and increased student performance in the traditional condition. Also, students in the technology-assisted condition may have had a false sense of confidence of knowing the material because they already had all of the main points of the lecture provided in their notes. In theory, this may cause students to pay less attention to the lecture and miss class more often. However, student attendance was measured and indicated that student attendance in the technology-assisted and traditional conditions did not differ significantly.

Even though student performance did not benefit from a technology-rich learning environment, teaching evaluation data indicated that the use of technology increased student satisfaction. Quantitative data from teaching evaluations indicated slightly, but significantly, higher ratings in the technology-assisted condition than the traditional condition. Also, qualitative data from the teaching evaluations demonstrated more positive student comments in the technology-assisted condition than the traditional condition. In fact, the majority of the student comments in the technology-assisted condition specifically mentioned positive statements about the effective use of WebCT and PowerPoint in the course. From this finding, one may conclude that technology-assisted instruction may motivate students by increasing enjoyment and interest in the material, but such motivation may not necessarily lead to better student performance. It may be the case that while technology-
assisted instruction increases organization and clarity of presentation, it may not increase students’ synthesis and reasoning (George & Sleeth, 1996).

**Conclusion**

A follow-up study, which is currently in progress, will investigate the effectiveness of providing students with partial lecture notes, rather than complete notes in technology-assisted courses. The process of writing the majority of the notes should capitalize on the generation effect and lead to better memory of the lecture material due to increased arousal and deeper processing at encoding. In summary, research investigating the effectiveness of technology-assisted instruction has resulted in mixed results. In light of this rather mixed data, it is disturbing that “accrediting agencies are including the use of technology as an essential component of a well-rounded education” (Branton & Lee, 2003, p. 11). This leaves one to question “whether technology is being used to comply with standards or to improve learning” (Branton & Lee, p. 11). It is the author’s belief that educators should not use technology in the classroom just for the sake of using it. Instead, educators should strive to develop innovative teaching strategies that increase student learning and comprehension. If the use of technology can help achieve this goal, then it should be considered for implementation in the classroom. The author also strongly believes that technology can be an effective tool for conveying information and creating a rich learning environment. However, one must first learn how to use the “tool” appropriately. Thus, it is imperative that further research be conducted to determine the most appropriate and effective uses of technology in education.

**References**


