Are Computer-Assisted Teaching Methods Effective?

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Two studies examined effects of computer-assisted (CA) teaching methods in introductory psychology classes. In Study 1, we provided students with lectures supplemented with either overhead transparencies or CA visuals. In Study 2, we compared students who used an optional Web site with students who did not. In both studies we held constant lecture content, course instructor, exams, and assignments. Results of the two studies showed that students liked the CA teaching interventions, although CA instruction had no effect on student performance in the courses. Based on these and other published findings, we recommend that universities examine closely their goals and priorities when devoting resources to instructional technology.

Teaching that incorporates computer tools has seen phenomenal growth over the past two decades. However, the development of classroom technology has outpaced the research published in assessing its effectiveness. Over a decade ago, Welsh and Null (1991) reviewed the research on computer-based instruction and concluded that empirical efforts were desperately needed to inform educators about the efficacy of computer-assisted (CA) teaching. Today, efficacy studies continue to be in short supply, despite calls for such scholarship (Hall, Watkins, & Ercal, 2000; Johnstone & Forsyth, 1996).

Publications on technology use in psychology classes emphasize the development of computer-based materials but devote less attention to how those materials affect student performance. CA teaching has been used creatively in a range of undergraduate psychology courses (Aberson, Berger, Healy, Kyle, & Romero, 2000; Brothen, 1997; Graham, 1997; Langston, 1998; Matthews, 1999; Neuhoff, 2000; Newcomb, Berkebile, Newman, & Parker, 1998; Plous, 2000; Riniolo, 1997; Sherman, 1998; Varnhagen, Drake, & Finley, 1997). Researchers typically find that student evaluations of CA instruction are overwhelmingly favorable (Aberson et al., 2000; Brothen, 1997; Graham, 1997; Newcomb et al., 1998; Plous, 2000; Sherman, 1998; Varnhagen et al., 1997). Although student evaluations are essential in judging the worth of a teaching tool, a number of researchers have gone a step further by investigating performance outcomes (e.g., grades). The results of these studies have been mixed, making it difficult to draw clear-cut conclusions about the efficacy of CA teaching (Erwin & Rieppi, 1999; Forsyth & Archer, 1997; Kazmerski & Blasko, 1999; Stoloff, 1995; Welsh & Null, 1991; Worthington, Welsh, Archer, Mindes, & Forsyth, 1996).

Our university invested in sophisticated classroom computer and projection equipment with the goal of improving instruction. We conducted the following studies to investigate the efficacy of teaching with this equipment. The first study examined the use of computer presentation software versus overhead projector presentation methods. The second study investigated the potential benefits of providing a course Web site as a resource for students.

Study 1

Given the mixed results of previous research, the direction of our hypotheses was influenced by the hope that our university’s investment in teaching resources was well spent. For Study 1, our hypotheses were (a) students in the CA condition would perform better than students in the traditional condition on final exam scores and overall course grades when American College Test (ACT) scores were statistically controlled, and (b) students in the CA condition would prefer CA presentations more than any other presentation style whereas students in the traditional condition would not prefer CA presentations.

Method

Participants. Eighty-three students were enrolled in one of two sections of an introductory psychology course at a small (approximate enrollment = 3,500), Midwestern, historically Black university with an open-admissions policy. The sample included 52 women and 31 men. Fifty-one percent of the sample reported being White, non-Hispanic; 42% African American, non-Hispanic; 2% Hispanic; 1% Asian American; and 4% other. Most participants (84%) were first-year students. Participants’ ages ranged from 18 to 39 with a mean age of 20.33 (SD = 3.82).

Design and procedure. We compared two sections of the same course. One section (n = 42), the traditional condition, received a standard lecture format with overhead transparencies as the primary lecture supplement. The CA section (n = 41) received a standard lecture format with Microsoft PowerPoint slides as the primary lecture supplement. The content of the overhead and computer-generated slides was similar, although the latter incorporated animation and sound into the presentations. Course instructor, lecture content, exams, and assignments were identical for the two sections. Course grades represented the mean of 10 classroom exams and 11 homework assignments. Because university policy specifies
that course changes are not allowed after the first week of the semester, students were not allowed to change sections after the first week of class. The traditional section met 1 hr prior to the meeting of the CA section. Both sections met three times a week for a 16-week semester. All students completed questionnaire packets at the beginning and end of the semester. The packets contained a demographics questionnaire and a survey that asked students to indicate which of the following types of presentation formats they preferred: lecture only, lecture with overhead slides, lecture with computer slides, or other.

Results

As a check for comparability of the groups, we compared the two conditions on ACT scores. There was no significant difference between the CA group (M = 17.51, SD = 4.18) and the Traditional group (M = 18.51, SD = 2.99), t(74) = 1.54, p = .33, η² = .03, observed power = .33. Hypothesis 1 predicted that students in the CA condition would earn higher grades than students in the traditional condition. ANCOVA of final course grades showed that the CA group (M = 74.89, SD = 11.30) and the traditional group (M = 76.18, SD = 11.78) did not differ when ACT scores were covaried, F(1, 65) = .03, p = .86, η² = .00, observed power = .05. Similarly, ANCOVA of final course grades showed that the CA group (M = 79.22, SD = 13.02) and the traditional group (M = 80.99, SD = 12.51) did not differ when ACT scores were statistically controlled, F(1, 73) = .001, p = .98, η² = .00, observed power = .05. In short, the two groups did not significantly differ in academic performance.

Hypothesis 2 predicted that at the end of the semester students in the CA section would prefer CA presentations, whereas the students in the traditional section would not indicate a preference for such presentations. None of the students in the traditional section preferred CA presentations, χ²(3, N = 36) = 54.89, p < .001. Among students in the CA section, nearly one third preferred the CA presentation format, χ²(3, N = 37) = 8.08, p = .04. No student in either section preferred CA presentations at the beginning of the semester. Although these results appear to support Hypothesis 2, they must be qualified by the possibility that students in the traditional section may have had no exposure to CA presentations and, thus, may have had no information on which to base their opinions.

Study 2

Educators are increasingly using course Web sites to supplement information presented in the classroom (National Education Association, 2001). Study 2 examined the efficacy of an optional Web site for an introductory psychology course. In addition to examining the association between use of the Web site and course grades, we sought to determine whether use of the Web site was associated with students’ experiences with and attitudes toward computers. Our hypotheses for Study 2 were (a) students who used the Web site would outperform students who did not use the Web site when ACT scores were statistically controlled, (b) Web users would prefer the use of the Internet for course-related activities more than nonusers, and (c) students who used the Web site would report more non-course-related computer use, higher computer self-efficacy, and fewer computer hassles at the end of the semester.

Method

Participants. Students (N = 112) were 42 men and 70 women enrolled in introductory psychology. Fifty-three percent of the sample reported being White, non-Hispanic; 37% African American, non-Hispanic; and 10% other. Sixty-two percent were first-year students, 12% were sophomores, 88% were juniors, and 6% were seniors. Participants ranged in age from 17 to 38 with an average age of 20.67 (SD = 4.40). Forty-eight percent of participants reported owning a personal computer. All participants had the opportunity to use a class Web site generated with the use of BlackBoard software.

Design and procedure. We compared students who chose to use the Web site (CA group, n = 60) to those who did not use the Web site (traditional group, n = 52). The Web site offered a copy of the instructor’s class notes, a 30-item multiple-choice practice test for each exam, announcements of due dates and upcoming exams, a copy of the syllabus, and study guides for each exam. The instructor provided all participants with paper copies of the syllabus and study guides as well as in-class oral announcements of upcoming due dates and exam dates.

We used the following instruments: a 13-item demographic questionnaire, students’ final grades in the course (scores included 10 multiple-choice exams and 24 assignments), a mean of all exam scores, a 2-item Likert-type scale measuring student liking of Internet activities designed for classes (1 = strongly disagree, 5 = strongly agree), an 8-item Likert-type evaluation of the course Web site (1 = strongly disagree, 5 = strongly agree) completed by participants who had used the Web site by the end of the semester, a 26-item Likert-type assessment of computer self-efficacy (Torkzadeh, Pfughoeft, & Hall, 1999), a 37-item assessment of computer hassles (scored on a 4-point scale rating the severity of the problem; Hudiburg, 1989, 1995), and a 21-item computer use questionnaire (scored on a 5-point scale rating the frequency of use; Panero, Lane, & Napier, 1997). We administered the last three scales twice, once at the beginning and once at the end of the semester.

Results

Students in the CA group reported accessing the Web site a mean of 13.03 times (SD = 8.34) by the end of the semester. At test showed that the CA group and the traditional group were not significantly different in ACT scores (CA group: M = 18.75, SD = 2.83; traditional group: M = 18.12, SD = 2.66), t(110) = –1.21, p = .23, η² = .01, observed power = .22. Hypothesis 1 predicted course Web site use would be associated with improved student grades. Results of ANCOVAs indicated that the two groups did not significantly differ in performance when ACT scores were statistically controlled. ANCOVA showed similar mean exam scores for the CA group (M = 75.10, SD = 13.12) and the traditional group (M = 71.22, SD = 16.61), F(1, 105) = .61, p = .44, η² = .01,
observed power = .12. Analysis of final course grades showed the same pattern (CA group: M = 77.30, SD = 14.02; traditional group: M = 75.81, SD = 12.51), F(1, 104) = .04, p = .84, η² = .00, observed power = .06.

As Hypothesis 2 predicted, the CA group (M = 4.13, SD = .66) reported liking Internet activities more than the traditional group (M = 3.84, SD = .69), F(1, 111) = 4.93, p < .05. The CA group also had a marginally positive response to the course Web site (M = 3.61, SD = .64). Thus, even though use of the Web site was not associated with higher grades, CA participants rated the Web site somewhat positively and liked the use of the Internet for course-related activities more than traditional participants did.

The third hypothesis predicted an association between Web site use and self-reported experiences with computers. More specifically, we expected that students who used the Web site would show higher scores on measures of computer use and computer self-efficacy and lower scores on computer hassles at the end of the semester. To control for potential differences between the CA and traditional groups, we used ACT scores and presemester scores (i.e., measures of computer use, computer self-efficacy, and computer hassles at the beginning of the course) as covariates in ANCOVAs. The two groups did not differ significantly in computer use, computer self-efficacy, and computer hassles at the beginning of the course as covariates in ANCOVAs. The two groups did not differ significantly in computer use, F(1, 79) = .33, p = .84, η² = .00, observed power = .05; or computer self-efficacy, F(1, 79) = .97, p = .33, η² = .02, observed power = .26. Students in the CA group (M = 1.01, SD = .69) reported less severe computer hassles than those in the traditional group (M = 1.58, SD = .71) at the end of the semester, F(1, 78) = 11.09, p < .05. Thus, Hypothesis 3 was partially supported.

General Discussion

Comparable to previous research (Aberson et al., 2000; Brothen, 1997; Graham, 1997; Newcomb et al., 1998; Plous, 2000; Sherman, 1998; Varnhagen et al., 1997), we found that students who were exposed to CA instruction rated it somewhat positively (Study 2), preferred it to other techniques (Study 1), or liked it more than students who were not exposed to it (Studies 1 and 2). Generally, our findings suggest that instructors could use classroom technology to attract students and enhance student enjoyment of courses. In addition, Study 2 found that students in the CA condition experienced less severe computer hassles than those in the traditional condition even when presemester hassles were statistically controlled. This result indicates that classroom computer technology may facilitate the computer skills of students. However, it is possible that students who chose to use the Web site also participated in other computer activities that led to a reduction in computer hassles.

As educators, our most important question in this investigation was whether revising our curriculum to include technology enhanced student learning. We were disappointed to find that neither the use of computer-generated slides (Study 1) nor an optional Web site (Study 2) resulted in improvements in student performance on course exams or final course grades. Our findings are consistent with some previous research (Kazmerski & Blasko, 1999; Stoloff, 1995; Welsh & Null, 1991), but are in contrast to other studies (Erwin & Rieppi, 1991; Forsyth & Archer, 1997; Worthington et al., 1996). Of these studies, some have been confounded by the use of different instructors for CA and traditional conditions (Erwin & Rieppi, 1999; Welsh & Null, 1991), by having no control group (Forsyth & Archer, 1997), or by mandating additional instruction time for CA conditions (Worthington et al., 1996). Previous studies that controlled for these problems (Kazmerski & Blasko, 1999; Stoloff, 1995) and this study, which used a quasi-experimental approach, found no statistically significant effects on student exam scores. These results suggest that future tests of CA instruction in psychology courses should strive to increase the discrepancy between the control and experimental groups by strengthening the CA intervention. Alternately, future research could focus on identifying specific student groups (e.g., highly visual learners; Smith & Woody, 2000) to determine whether certain types of students benefit more than others from CA instruction.

Our studies were limited by several factors. One limitation was the lack of random assignment to conditions. Even though we statistically controlled for group differences in ACT scores, there may have been other differences between the groups. Second, participants were students at an open-admissions, historically Black university. Hamilton (2001) noted that historically Black university students are less likely to have access to computers when compared to students at other universities. Less than half of the students in Study 2 indicated that they owned a computer. Perhaps students with more access to computers would have yielded different results. Finally, for both our studies, estimates of statistical power and effect sizes were small. The combination of low statistical power and small effect sizes may be the reason for nonsignificant results. Although the sensitivity of our statistical tests would have been enhanced by larger sample sizes, the effect sizes would remain small.

In an effort to upgrade technology in psychology courses, the administration at our university awarded us high-end computer resources and intensive training on their use. Such awards were relatively rare on our campus at the time of this investigation. We conducted these studies to demonstrate that such investments improve student learning. We found that students liked our technology-enhanced classes, but the students did not earn better grades. The fact that students like CA instruction may be valuable to administrators and educators who are attempting to recruit and satisfy students. However, these benefits are moderated by several factors, including the cost of equipment purchase and maintenance, the cost of faculty training, and the time expenditure necessary for developing new classroom materials. To date, research has not yet established the types of CA teaching interventions that are effective in improving student performance in psychology courses. Therefore, we recommend that administrators conduct thorough cost–benefit analyses before devoting extensive resources to instructional technology.

References


Notes

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