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SYMPOSIUM: COMPUTER ATTITUDES AND THE USE OF COMPUTERS IN PSYCHOLOGY COURSES

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Computer attitudes and the use of computers in psychology courses

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Students enrolled in four psychology courses in which computers were used for different purposes completed both pre- and postcourse surveys regarding their prior computer experience, their attitudes toward computers, and their locus of control. A fifth psychology course in which computers were not used served as a control. Results showed that participation in the courses that involved computer activities led to more positive attitudes toward computers than did the control condition. In addition, the positive changes in computer attitudes were found to be independent of initial student characteristics and unrelated to course performance. There was also some suggestion that courses that have higher levels of direct involvement with computer applications may lead to the most positive attitude changes.

The decades of the 80s and 90s saw a rapid increase in the use of computers in instruction (Becker, 1992). Consistent with this trend, surveys of psychology faculty throughout this period (Anderson & Hornby, 1990; Castellan, 1982; Hornby & Anderson, 1994) have revealed that college-level psychology courses have also been significantly affected by the use of computers. The data from these surveys indicate that computers are now routinely being used in psychology instruction for conducting statistical analysis, supporting laboratory demonstrations, conducting research, word processing, and test administration. Although courses such as research methods, statistics, cognition, and introductory psychology are the most likely to include computer use, a large range of other courses are reported as doing so too.

During the same general time period, there has also been an increasing interest in understanding the impact of students' attitudes on their academic performance (Al-Nhar, 1992; Mickelson, 1990; Multon, Brown, & Lent, 1991). Not surprisingly, students' attitudes toward computers (Lawton & Gerschner, 1982; Munger & Loyd, 1989) have received a great deal of attention. Some of the questions examined have been how these attitudes are initially formed, how they are modified, and how they might influence academic performance.

Despite the frequent use of computers to support instruction in psychology courses, the effect that this use may have on student attitudes toward computers, or the effect that existing student attitudes may have on student performance in these particular courses, does not appear to have received attention in the research literature. The goal of the present research was to explore the relationship between individual student characteristics, computer attitudes and beliefs, course experience, and academic performance among students enrolled in psychology courses that involve computers.

One direction of current research on computer attitudes has been an attempt to determine the relationship between specific characteristics of individuals in relation to their attitudes toward computers. One characteristic that has received a large amount of attention is gender (Colley, Gale, & Harris, 1994; Loyd & Gressard, 1986; Pope, Donald, & Twing, 1991). Although gender differ-

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ences are often apparent, these studies indicate that, in general, if other important variables (e.g., math anxiety and computer experience) are controlled, there is no clear difference between the attitudes of males and females toward computers.

Although global variables such as gender may not be critical, studies designed to examine the role of specific personality dimensions on attitudes toward computer use have revealed some interesting relationships. With regard to the personality dimension of locus of control, Hawk (1989) revealed that there is a complex interaction between computer involvement, locus of control, and attitudes toward computers. Subjects with an external locus of control who were not highly involved with computer use had a less positive attitude toward computer use than did subjects with either internal or external locus of control who had been highly involved.

Despite some weak relationships between a number of subject variables such as those discussed above and individuals' attitudes toward computers, the factor that appears to be the single best predictor of attitudes toward computers appears to be previous experience (Arthur & Olson, 1991; Colley et al., 1994; Hawk, 1989; Loyd & Gressard, 1986; Pope et al., 1991). Overwhelmingly, subjects with higher levels of computer experience demonstrate more positive attitudes toward computers as well as lower levels of computer anxiety. Lending additional support to this documented relationship are a number of studies that have been designed to explore the possibility of changes in students' attitudes toward computers as a result of enrollment in courses using computers (McInerney, McInerney, & Sinclair, 1994; Morris, 1994). However, these studies have primarily been conducted on students enrolled in computer courses and have generally not examined possible changes as a result of enrollment in courses that require students to use computers to engage in academic components of domain-specific courses. Thus, one question being addressed by the present research concerns whether the involvement with the use of computers in a single psychology course is an experience sufficient to produce such attitude changes.

In addition to the effort to understand the factors that influence attitudes toward computers, there has also been considerable interest in the question of whether computer attitudes influence students' academic performance in courses in which computers are employed. Munger and Loyd (1989), for example, explored the relationship between attitudes toward technology (computers and calculators) and students' performance in mathematics. Their research indicated that subjects with more positive attitudes toward technology performed better than subjects with more negative attitudes. Thus, an additional question addressed in the present study is whether initial attitudes toward computers are related to student performance in psychology courses that include computer use.

In order to study attitudes toward computers, a number of measurement instruments have been developed and evaluated over the past 10 years. Some of these instruments focus on the single dimension of computer anxiety, whereas others have taken a more multidimensional approach. Research designed to evaluate the reliability and validity of a range of computer attitude surveys (Dukes, Discenza, & Couger, 1989; Gardner, Discenza, & Dukes, 1993; Woodrow, 1991; Zakrajsek, Waters, Popovich, Craft, & Hampton, 1990) has arrived at the conclusion that the available measures display a good deal of consistency and overlap. In a comparative analysis of four popular measures, Woodrow (1991) concluded that the Computer Attitude Scale (CAS; Gressard & Loyd, 1986) "appears to give an excellent, reliable measure of overall computer attitude." In addition to being an overall attitude measure, CAS provides scores for the four subscales of Computer Anxiety, Computer Confidence, Computer Liking, and Computer Usefulness. This instrument is described by the authors as a "convenient, reliable and valid measure of computer attitudes that can be confidently and effectively utilized in research and program evaluation contexts" (Gressard & Loyd, 1986). Because of the amount of research that has been conducted to verify the reliability and factor structure of this instrument (Gardner et al., 1993; Gressard & Loyd, 1986; Loyd & Gressard, 1984), it was decided to adopt CAS as the primary measure of attitudes for the present investigation into various dimensions of students' attitudes toward computers.

Based on the review of the literature presented above, the present research was designed to explore the relationship between gender, age, year in school, locus of control, and extent of previous experience with computers in relation to psychology students' attitudes toward computers, specifically their levels of anxiety about computers, their confidence in using computers, their liking of computers, and their perception of the usefulness of computers. The present research was also designed to determine the extent to which students' attitudes toward computers would change as a result of computer experience embedded in psychology courses, and specifically how different types of computer use might affect the nature of such changes. Finally, this study was designed to examine the possible relationship between students' attitudes (and attitude change) and their academic performance within the psychology courses being investigated.

METHOD

Subjects

Participants were 232 undergraduate students at four State University of New York Colleges located at Cortland, Plattsburgh, Oswego, and Geneseo. These four institutions were selected because of similar locations, student characteristics, and academic emphasis, as well as the fact that computers were being used in substantially different ways within psychology courses at these institutions. All students who participated in the study were enrolled in psychology courses that were conducted during the spring 1995 academic semester, and all were fully informed about the nature of the research and were assured of the confidentiality of their responses.

A total of five different courses, each involving a different instructor, was included in the investigation. A control condition consisted of 42 students enrolled in an educational psychology course at Cortland College that had no specific requirement for the use of computers. All other subjects were enrolled in courses that required computer use. At Cortland College, 72 subjects were enrolled in an educational psychology course (Anderson, 1996) that required them to engage in computer-mediated conferencing (communication). Thirty-seven subjects at Plattsburgh College used computers primarily for assessment (testing) in their self-paced introductory psychology course (Hornby, 1996). At Geneseo College, 69 subjects used computers to engage in tutorial assignments (statistics) in support of their behavioral statistics course (Collins, 1995). Finally, 12 students at Oswego College were required to program experiments (experimentation) in On-line Computers in Psychology, an advanced laboratory course (Sargeant, 1996). The demographic characteristics of the sample are reported in the Results section below.

Materials

The survey instrument consisted of four parts. These included questions regarding the basic demographic information, a set of questions about the extent of previous experience with computers, the Locus of Control Questionnaire, and the Computer Attitude Scale developed by Loyd and Gressard (1984).

Previous experience with computers was assessed by asking students to respond to nine items on a 4-point Likert type scale which varied from *no experience at all* to *a lot of experience*. The specific computer activities measured included the use of computers for word processing, statistics, programming, drill and practice, test taking, simulation and modeling, data collection, gaming, and other purposes.

The Computer Attitude Scale (Gressard & Loyd, 1986) comprises 40 questions which make up the four subscales of Computer Anxiety, Computer Confidence, Computer Liking, and Computer Usefulness. Each subscale consists of 10 items and presents positively and negatively worded statements such as "Computers do not scare me at all" and "Learning about computers is a waste of time." For each item, the subject responds on a 4-point Likert-type scale varying from *strongly agree* to *strongly disagree*. Item responses are coded so that a higher score corresponds to a higher degree of liking, confidence, or perception of usefulness, and a lower degree of anxiety. Scores on any subscale can range from 10 to 40, with a higher score indicating a more positive attitude. An overall measure of computer attitude (Global Attitude) is obtained by computing the average of the four subscale scores.

Subjects also completed Rotter's Locus of Control Scale (1966), which consists of 20 forced-choice items. For each item, the subject must choose either the "a" or the "b" item, which consists of statements such as "a) Grades are a function of the amount of work students do" or "b) Grades depend on the kindness of the instructor." The total score, which can range from 0 to 20, is computed as the total number of "internal" items (e.g., "a" above) that the subject selects.

Procedure

Each of the five instructors participating in the present research project provided the opportunity to complete all of the scales described above to students enrolled in their courses during the first scheduled week of classes in January 1995. For the remainder of the semester, they conducted their courses in their regular manner (Anderson, 1996; Collins, 1995; Hornby, 1996; Sargeant, 1996). During the final week of scheduled classes in May 1995, the instructors again administered the Computer Attitude Scale. Following the completion of the semester, the responses to the various surveys were computer scanned and aggregated; these data, along with students' final course grades, were entered into one database for purposes of statistical analysis.

RESULTS

All analyses in this research are based on a total of 187 subjects who completed both the pre- and the posttest components of the study. For these subjects, the raw data from the pretest survey consist of self-reports for gender, age, level in school, and prior computer experience, as well as scores for the Locus of Control Questionnaire and the Computer Attitude Scale. The posttest data consist of Computer Attitude Scale scores obtained at the end of the semester, as well as course performance as reflected by final course grades.

Group Composition

Although we are primarily interested in the effect of course experience on computer attitudes as well as any relationship between attitudes and course performance, it is important to look at the initial composition of the five groups of subjects in the five courses. These data are presented in Table 1. Even a cursory review of these data reveals that the five groups were quite varied in their makeup. Group size ranged from 11 up to 71 students; gender composition ranged from mostly females (82% for the control group) to fewer than half females (42% for the computer testing group). Level in college varied considerably as well. A large number of seniors were enrolled in the computer experimentation course, whereas the computer communication course contained mostly sophomores. Although most of the subjects were between the age of 19 and 22 years, two of the groups (control and experimentation) had more students in the upper age levels than did the other three classes.

The average amount of computer experience is shown on a 4-point scale with 1 = *no experience* and 4 = *a lot of experience*. Although amount of reported experience did vary across the groups, a one-way analysis of variance (ANOVA) revealed that the five groups did not differ significantly in terms of their overall computer experience. Separate analyses on the specific types of computer experience did reveal significant differences in terms of reported experience with the use of computers for statistics ($F = 8.47, p < .0001$) and "other" computer experience ($F = 2.72, p = .0309$). A one-way ANOVA revealed that Locus of Control scores did not vary significantly. Finally, initial computer attitude scores did vary across the groups. A one-way ANOVA revealed that the existing differences were significant on the attitude subscales of Computer Anxiety ($F = 2.56$, $p = .0397$) and Computer Confidence ($F = 5.29, p = .0005$). This finding appears to be primarily attributable to the somewhat lower attitude scores of the students in the statistics course.

Determinants of Computer Attitudes

Because of the variation among the characteristics of the five subject groups, we felt it important to determine the extent to which gender, age, locus of control, or level in school was contributing to the initial variation in computer attitudes. A series of one-way ANOVAs was conducted to determine these relationships. Although males

Table 1
Group Composition: Number of Subjects in Each Course by Gender, Age, and Level as Well as Mean Scores for Prior Computer Experience, Locus of Control, and Pretest Computer Attitudes

	Course Group					
Variable	Control	Computer Statistics	Computer Testing	Computer Communication	Computer Experimentation	All Subjects
Total subjects*	30	71	23	54	11	189
Gender						
Female	23	42	9	39	6	119
Male	5	25	12	15	4	61
Level						
Freshman	0	0	5	3	0	8
Sophomore	4	34	4	35	0	77
Junior	15	27	7	9	2	60
Senior	9	6	5	5	8	33
Age (years)						
18	0	1	3	1	0	5
19–20	10	41	10	41	1	103
21–22	12	16	6	8	8	50
>22	6	9	2	2	1	20
Computer Experience						
Mean score	2.15	2.15	2.28	2.13	2.51	2.24
Locus of Control						
Mean score	15.27	15.06	15.03	15.51	15.81	15.34
Initial Computer Attitude Scores						
Mean anxiety	29.43	25.92	30.13	29.27	29.18	28.79
Mean liking	26.30	25.66	28.40	26.99	29.27	27.32
Mean confidence	26.67	24.10	28.65	27.23	28.46	27.02
Mean usefulness	32.50	34.12	33.30	33.72	34.64	33.66
Global attitude	28.73	27.37	30.12	29.30	30.39	29.18

*Because of incomplete demographic reports, data provided below may not sum to this number.

had slightly higher overall computer attitude scores than did females (29.30 vs. 28.66), this difference was not found to be significant, nor were there any significant differences between males and females on the individual computer attitude subscales. Comparisons of computer attitudes across the four college levels also failed to reveal any significant differences.

In order to analyze the potential role of internal locus of control, subjects were divided into three groups on the basis of their scores. Scores on this scale range from 0 to 20, with the higher score representing a more internal locus of control. This three-way division resulted in scores from 0 to 14 being classified as low ($N = 67$), scores of 15 or 16 being classified as middle ($N = 63$), and scores of 17 to 20 being classified as high ($N = 59$). One-way ANOVAs were used to compare these three groups in terms of their initial computer attitudes. This analysis revealed no significant differences on any of the attitude subscales or the overall global attitude. Overall reported computer experience was also used to create high, middle, and low computer experience groups. Scores on this scale ranged from 1, *no experience*, to 4, *a lot of experience*. The low group ($N = 62$) subjects had mean computer experience scores of 1–2.55, the middle group ($N = 57$) had scores ranging of 2.56–3.14, and the high group ($N = 53$) had scores of 3.15–4.0.

Again, a one-way ANOVA was used to determine whether these three groups differed in terms of their pretest computer attitude scores. This analysis revealed significant differences for all of the attitude scales except computer usefulness. In all cases, a greater amount of computer experience was associated with more positive attitudes (higher scores). The mean scores for the computer anxiety subscales for the low to high experience groups were 25, 28.9, and 31.2 ($F = 14.8$, $p < .01$); for computer liking, the mean scores were 24.5, 26.5, and 29.2 ($F = 12.2$, $p < .01$); for computer confidence, the mean scores were 24.3, 26.3, and 28.8 ($F = 14.93$, $p < .01$); for computer usefulness, the mean scores were 32.8, 33.7, and 34.16 (n.s.). Overall, global computer attitude scores were also significantly different ($F = 14.57$, $p < .01$) and ranged from a low of 26.7 to a high of 30.8.

Changes in Computer Attitudes

Since these findings suggest that experience with computers is a major factor related to positive computer attitudes, we might anticipate that computer attitudes would improve with the computer use associated with the four types of computer experience involved in the courses in this study. To determine whether this was the case, an attitude change score was computed for each subject on

each of the four attitude subscales as well as the global attitude scores. These change scores were then analyzed in an ANOVA with planned comparisons between the control group and the four courses that used computers. Because of the previously demonstrated variation among the groups, the variables of gender, level, age, reported computer use, and locus of control were used as covariates. For each of the attitude scales, the mean change scores as well as the omnibus F ratio are reported in Table 2. It can readily be seen that for each of the four computer groups, there were positive attitude changes on all the subscales as well as the overall global attitude measure. The control group, on the other hand, revealed mostly negative attitude changes, except in computer confidence. Significant differences across the five groups were revealed for computer anxiety, computer usefulness, and overall global attitude change. In addition, individual planned comparisons showed that the computer experimentation group differed significantly from the control group on all five attitude scales, while three of the groups differed significantly from the control in terms of decreases in computer anxiety. Although change scores were not always significant, these results clearly show that the course experiences yielded positive attitude changes.

In the preceding analyses, initial differences among the subjects as revealed by the pretest were used as covariates. However, it was also possible to determine whether the amount of change in attitudes was affected by any of these variables. To determine this, attitude changes scores were compared across gender, college level, age, and locus of control groups (low, middle, and high internal) as well as the low, middle, and high computer experience groups. Separate one-way ANOVAs failed to show any significant variation in the amount of attitude change as a function of these variables.

Computer Attitudes and Course Performance

In addition to the preceding questions, we were also interested in whether initial computer attitudes were related to course performance, as well as in whether course performance was a factor in determining attitude change. To answer the first question, Pearson product–moment correlations were computed between final course grade and initial computer attitude subscale scores. These correlations were computed for the students in the courses with computers taken as a group as well as for each of the course groups taken separately (no grades were available for the control group). The resulting correlations, none of which were significant, ranged from −.05 to +.14.

In order to determine whether changes in students' computer attitudes were related to course performance, correlations were also computed between course grades and attitude change scores. Again, only small correlations were obtained (less than .15), and none were found to be significant.

Although initial attitudes did not appear to be related to course performance, a final question that needed to be answered was whether previous experience with computers was related to course performance. This was also analyzed by computing correlations between reported computer use and final grades, both for the overall sample as well as for each instructor separately. Correlations ranged from −.07 to +.15. None were significant.

DISCUSSION

As psychology instructors, as well as instructors in other fields, continue to incorporate computers into their courses' instructional design, it is important to determine the potential impact of this historical development on students' attitudes and performance. The purpose of the present study was to look at computer attitudes, computer attitude changes, and the relationship between attitudes toward computers and academic performance as a result of specific computer experience in four psychology courses in which computers were employed in very different ways. From the basis of our results, a number of observations can be made.

First, as might be expected, students come to psychology courses with a considerable range of attitudes and previous experience with regard to computers. However, the results of the present study suggest that initial differences in computer experience and/or variations in students' attitudes toward computers do not appear to affect the potential benefits of working with computers nor do they appear to affect student performance, at least in terms of final grades. These findings should be reassuring to those who think that the use of computers might put less experienced, or more anxious, students at a disadvantage.

Secondly, consistent with previous findings, the present study confirms the general observation that the most important factor in determining student attitudes toward computers is their amount of previous experience. Other factors such as gender, age, level, or the personality di-

Table 2
Mean Computer Attitude Change Scores for Course Groups

Computer Attitude Subscale	Control	Computer Statistics	Computer Testing	Computer Communication	Computer Experimentation	Omnibus F Ratio	p
Comp. anxiety	−.56	+2.14*	+1.89*	+1.15	+4.7*	3.87	.0049
Comp. liking	−.19	+0.82	+0.33	+0.68	+3.0*	1.06	n.s.
Comp. confidence	+.19	+1.49	+0.94	+1.00	+3.4*	2.02	n.s.
Comp. usefulness	−.74	+0.28	+1.39	+0.18	+3.0*	2.48	.0481
Global attitude	−.32	+1.18	+1.14	+0.75	+3.5*	3.47	.0095

*Group mean is significantly different from the control condition by planned comparison F tests ($p < .05$).

mension of locus of control do not appear to be directly related to general attitudes toward computers nor do they appear to affect the extent of computer attitude change resulting from direct experience with computers. It should be pointed out, however, that any observational data that show more positive attitudes among students who have had greater computer experience are ambiguous in terms of the causal direction of this relationship. It may be that computer experience tends to produce more positive attitudes; however, it is also possible that students with positive attitudes tend to seek out computer experience. As discussed below, the present study provides some evidence that it is the experience itself that leads to the attitude change.

Our major finding, then, is that student participation in psychology in which computers are employed appears to lead to positive computer attitude changes, even in courses in which computers are employed in such varied ways as testing, communication, experimentation, and statistics. The fact that these students' initial computer attitudes were no more positive than those of students enrolling in the control course without computers is at least limited evidence that existing computer attitudes do not determine selection of courses employing computers. On the other hand, it appears to be the case that among courses in which computers are employed, the particular type of computer application affects the extent of attitude change. The high level of involvement with computers in a course that dealt with on-line experimentation clearly led to more positive changes in computer attitudes than did courses in which computers were more of a tool for teaching the course content.

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