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ABSTRACT

Today's technological development in multimedia, Internet, and CD-ROM provides opportunities to use computer-assisted instruction (CAI) for diverse applications. This study examined the following questions: (1) do significant differences exist in the preference for CAI between male and female students? (2) do significant differences exist in the preference for CAI between undergraduate and graduate students? and (3) does an interactive effect exist between student gender and academic status (undergraduate versus graduate)? Seventy-six students at a university in the mid-south of the United States were randomly selected to answer the survey questionnaire. Analyses of variance showed that academic status was the only one significant main effect at the .05 level. Graduate students favored CAI more than did undergraduate students, probably because most of them had jobs and needed to learn CAI use at a more convenient time and place. This result confirms the assumption that graduate students have more computer experiences. Since computer literacy increases as time passes, the chance of experimentation with CAI becomes greater. The association of academic status with the preference for CAI was found to be strongly positive. The option mix of CAI with good traditional lectures in higher education must be the key element to the success of any instruction in technologically sophisticated societies of today. (AEF)

THE UNIVERSITY STUDENT'S PREFERENCE FOR LEARNING BY COMPUTER-ASSISTED INSTRUCTION

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ABSTRACT

Today's technological development in multimedia, Internet, and CD-ROM provide opportunities to use computer-assisted instruction (CAI) for diverse applications. The questions for the study reported here were: Do significant differences exist in the preference for CAI between male and female students? Do significant differences exist in the preference for CAI between undergraduate and graduate students? And does an interactive effect exist between student gender and academic status (undergraduate versus graduate)? Seventy-six students at a university of the mid-south in the United States were randomly selected to answer the specially designed survey questionnaire. Analyses of variance showed that academic status was the only one significant main effect at the .05 level. Graduate students favor CAI more than do undergraduate students, probably because most of them have jobs and need to learn using CAI at a more convenient time and place. This result confirms the assumption that graduate students have more computer experiences. Since computer literacy increases as time passes, the chance of "give CAI a try" becomes higher. The association of academic status with the preference for CAI was found to be strongly positive. In sum, the option mix of CAI with good traditional lectures in higher education must be the key element to the success of any instruction in technologically sophisticated societies of today.

THE UNIVERSITY STUDENT'S PREFERENCE FOR LEARNING BY COMPUTER-ASSISTED INSTRUCTION

Yukiko Inoue, University of Guam

Computer-assisted instruction (CAI) refers to all kinds of instructional systems in which computers are used to support teaching; but drill and practice, simulation, and tutorial are the three main CAI formats (Kearsley, 1993). Why has CAI, which had made only minor progress in classroom implementations during the past thirty years, returned to the limelight in the 1990s? Probably because of an increasing amount of knowledge to be delivered in a limited amount of time in the class and because of an increasing number of students, resulting in each student's receiving less attention in larger classes. Consequently, the quality of education is deteriorating, and teachers are burning out quickly. One way to overcome this situation is to support teaching with individualized programmed instructions such as CAI. Today's technological development in multimedia, Internet, and CD-ROM provide opportunities to use CAI for diverse applications.

Although neither females nor males perceive computers as belonging to the male domain, females are more likely than males to be unsure of their ability to use computers (Makrakis, 1993). The student with greater computer experience and who has a propensity for an in-depth learning is inclined to prefer CAI (Jones & Kember, 1994) as well as to have a more positive attitude toward computers (Felter, 1985). This study was designed, therefore, to explore the interactive relationship between "gender" and "experience" on the preference for CAI.

Review of the Literature

Gender Differences

As maintained by Colley, Gale, and Harris (1994) and Schumacher, Morahan-Martin, and Olinsky (1993), such variables as prior experience, computer at home, and personality produce gender differences toward computers; therefore, if these variables are eliminated, there will be no gender difference in computer proficiency. Culley (1988) urged the necessity of conquering the tendency toward male dominance in computer usage. Reinen and Plomp (1993) found that computer usage at school was dominated by boys in most of the twenty-one countries they surveyed, yet half of those countries had policies to encourage girls to use computers in grade and high schools.

There is the extensive study on computer in general, albeit there are only a few studies on computer and gender (Clariana, 1992). Hattie and Fitzgerald's (1987) meta-analyses of studies concerning computer usage, achievement, and attitude found small differences in attitude but no difference in achievement and usage between both sexes. It is instead biases and stereotypes that are responsible for perpetuating women's negative attitude toward computers and, if such views continue, the future for women and computer will be bleak (Reinmann, 1986; Towns, 1984).

Computer Experiences

Gender differences in computer experience are viewed to appear at early ages and to continue into maturity. In grade and high schools, boys are inclined to have more exposure to computers than are girls (Hess & Miura, 1985). In college, males are more likely than females to take computer courses (Dambort, Silling, & Zook, 1988; Popovich, Hyde, Zakarajsek, & Blumer, 1987), to use computer labs (Lockheed, 1985), and to have access to dormitory computers (Modianos & Hartman, 1990). Males enjoy computer programming and games more than do females (Wilder, Mackie, & Cooper, 1985). Gender differences, however, disappears when word-processing is involved (Linn, 1985). These conflicting results strongly suggest the necessity of doing further investigation.

An interactive effect between computer experience and gender difference cannot be ignored (Loyd, Loyd, & Cressard, 1987). In a definition of student attitudes toward computers, in reality, computer experience is hard to assess simply because experience does not necessarily mean knowledge itself (kay, 1992). For instance, experience of word-processing differs from that of spreadsheet. This study equates computer experience with academic status (in this case, undergraduate versus graduate students) from the assumption that graduate students have more computer experiences than do undergraduate students and therefore graduate students are more likely than undergraduate students to express positive attitudes toward CAI.

Method

Research Hypotheses

Student participants were divided into the four groups: Undergraduate males (UM), undergraduate females (UF), graduate males (GM), and graduate females (GF). The research question was posed as to whether gender or experience (academic status) would impact the preference for CAI. It was hypothesized that gender would have an interactive effect with academic status on the preference for CAI. It was also hypothesized that male students would have a stronger preference for CAI than would female students. That is, a prior expectation was that male (and graduate) students might have stronger preference for learning by CAI than do female (and undergraduate) students.

Procedure and Data Collection

Seventy-six undergraduate and graduate students taking courses at a university (with an enrollment of over 20,000) of the mid-south in the United States were randomly selected to participate in the study ($N = 76$). A specially designed survey questionnaire was developed, pilot tested, and administered to all the participants, who were asked whether or not they preferred taking such a structured course as chemistry using CAI or taking the same course in conventional instruction in a larger class. The participants responded on a 5-point Likert scale (5 = Like CAI very much, 4 = Like CAI somewhat, 3 = Undecided, 2 = Like conventional instruction somewhat, 1 = Like conventional instruction very much). The students were also asked how frequently they use computers (3 = Quite often, 2 = Sometimes, 1 = Seldom). All the answers considered to be valid for the data analysis.

Statistical Analysis

The principal questions were as follows: (1) Do significant differences exist in the preference for CAI between the groups of male and female students? (2) Do significant differences exist in the preference for CAI between the groups of undergraduate and graduate students? And, in particular, (3) does an interactive effect exist between student gender and academic status?

The analysis began with a two-factor-random-effects analysis of variance (ANOVA) using the preference for CAI as the dependent variable and student gender (male versus female students) and academic status (graduate versus undergraduate students) as the independent variables. ANOVA was chosen because of the interest in testing for an interaction between the independent variables and because a series of *t* tests might result in a large alpha error. The alpha was set at .05. Table 1 illustrates the distribution of all the participants in a 2 x 2 factorial design.

Table 1

Distribution of the Participants Across Cells

Gender	Undergraduate	Graduate
Male	UM (N = 19)	GM (N = 19)
Female	UF (N = 19)	GF (N = 19)

Results

Since the tests for homogeneity of variance (Cochran's C = .414; Bartlett-Box F = .255) failed to reject the null hypothesis of equal variance, the data met the assumption for the use of the statistical method that processed through the following steps: Analysis of variance, post hoc tests, and chi-square test.

Analysis of Variance

As shown in Table 2, academic status was the only one significant main effect. The F-test produced significant results at the .05 level (F-value = 8.43). Not surprisingly, the overall mean score for graduate students was 3.82 compared to 3.05 for undergraduate students. Presumably, most graduate students have a job (that is, they are part-time students) and have a need to learn using CAI at a more convenient time and place. Furthermore, graduate students have more computer experiences which promote a positive attitude toward CAI. Surprisingly, however, the main effect of student gender proved nonsignificant at the .05 level (F-value = 3.62), supporting the finding of Colley et al. (1994). The overall mean scores (3.68 for males; 3.18 for females) did not differ in the preference for CAI. As illustrated in Figure 1 (Appendix A), the interactive effect between student gender and academic status (undergraduate versus graduate) was also nonsignificant at the .05 level (F- value = .25), supporting the finding of Schumacher et al. (1993) that there was no gender difference in preference for using the computer.

Table 2

Summary of Analysis of Variance of Gender and Academic Status on the Preference for CAI

Source	df	MS	F
Student Gender (SG)	1	4.750	3.618
Academic Status (AS)	1	11.066	8.429*
SG x AS	1	.329	.251
Error	72	1.313	

Post Hoc Tests

Post hoc multiple comparison tests were performed to determine which means differ significantly among four groups. While the Newman-Keuls indicated two differences between undergraduate females and graduate males and between undergraduate females and graduate females (neither of these pairs is underlined by the same line in Table 3), the Scheffe (the most conservative test) indicated only one difference between undergraduate females and graduate males. Therefore, the fact that there was no difference between undergraduate and graduate males made the results less conclusive in this study.

Table 3

The Results of the Ranked Means of the Student-Nuwman-Keuls Test

Group (G)	G3 (GM) N=19	G4 (GF) N=19	G1 (UM) N=19	G2 (UF) N=19
Mean	4.00	3.63	3.37	2.74

Note: Groups 1 and 2 are underlined by the top line; therefore, these groups did not differ significantly from each other. The lower line indicates that groups 3, 4, and 1 are not significantly different. Thus, two significant differences are between groups of 3 and 2 and between groups of 4 and 2.

Chi-Square Test

The association between academic status and computer usage is summarized in Table 4 (See Appendix B). The calculated chi-square was 6.96 compared to the chi-square critical of 5.991. A chi-square test indicated that the variable (the frequency of using the computer) was significantly associated with academic status (that is, computer experience) at the level of .05.

In other words, graduate students used the computer significantly more than did undergraduate students. Accordingly, the above results justify the decision to use academic status as computer experience in the independent variable of this study.

Discussion and Conclusion

This study has searched for an answer to the question of whether or not gender difference is associated with academic status (equated "computer experience") on the university student's preference for learning by CAI. The main effect of gender is nonsignificant, yet the result regarding gender may explode an almost universally accepted idea that males are more computer literate than are females. Gender inequalities existed before computers were introduced to schools (kirk, 1992). Information technology (IT) alone has not created gender inequalities but has the potential of severing it. Severing the inequalities is sought by those who claim that affirmative action is the only solution to the problem (Reinmann, 1986). IT may enhance affirmative action by providing detailed ad hoc reports to organizations and the government.

The main effect of academic status is significant. The finding that graduate students favor CAI more than do undergraduate students confirms the assumption that graduate students have more computer experiences. Since computer literacy increases as time passes, the chance of "give CAI a try" becomes higher. The association of academic status with the CAI preference is found to be strongly positive. Although the results do not tell exactly why graduate students favor CAI more than do undergraduate students, such learning activities as using CAI give maximum opportunities to all students with different backgrounds and academic expectations, particularly in graduate programs. The results also do not provide empirical evidence of the existence of the interaction of student gender with academic status on the preference for CAI. However, statistical tests showed the significant differences between undergraduate females and graduate males, supporting the position of Levin and Gordon (1989), who maintain that computer experiences have a stronger effect than do gender differences on attitudes toward the computer and CAI.

The results may correspond to the samples but not to the population due to the sample size (31 subjects per group are needed using alpha = .05, power = .80, and effect size = .50). Also it was possible that the participants had only minor ideas of what CAI is, and the measurements used were crude. If large scale study confirms the same results, the question should be raised as to what implementations can give university students optimal benefits from CAI. All university courses are not suitable for CAI (Economics and Psychology are ill-structured). Yet CAI can appear in many shapes from class presentations of CD-ROM to complete instructor-less environments (such as all self-study). In addition to the diversified student population, students today are using higher education differently than was the case a generation ago. University experience today is a life-long, often fragmented process which occurs at many points in an American individual's life, necessitating a more inclusive curriculum and a reexamination of traditional pedagogy and epistemology at all levels of higher education. In short, the results of this study suggest that the integration of valid programmed instructions with good lectures can be the best for improving the 21st century university teaching and learning.

Finally, university instructors should promote meaningful reception learning through such integrated teaching so that students can easily related to their existing knowledge schemes. Eventually, the option mix of CAI (computer-assisted or computer-aided instruction) with traditional teaching methods in (continuing) higher education must be the key element to the success of any institution in technologically sophisticated societies of today.

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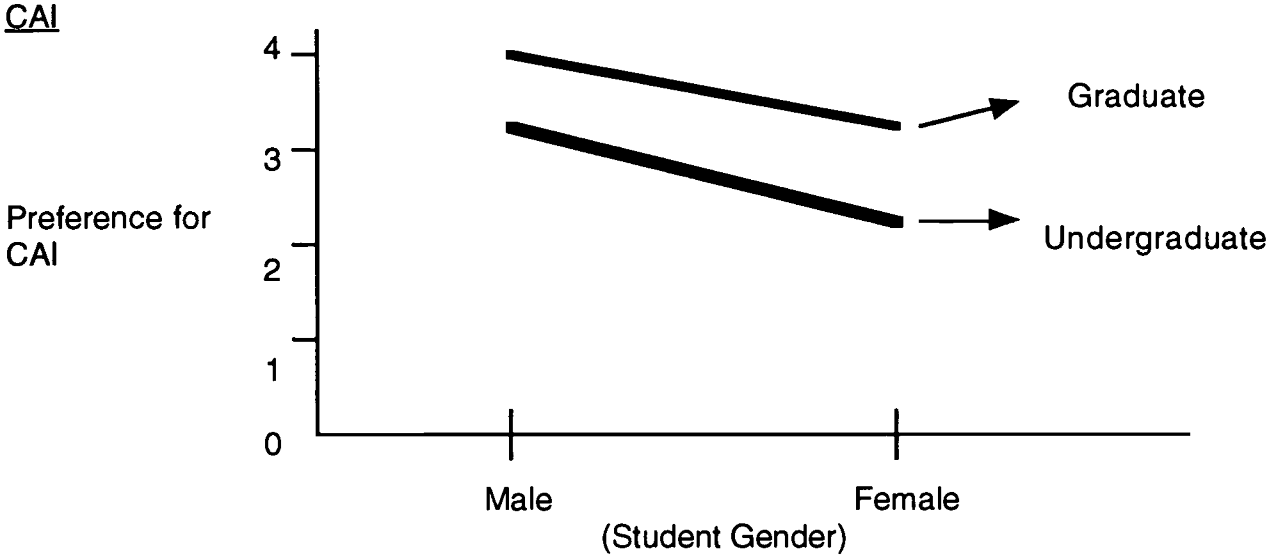
APPENDIX A

Figure 1

Effects of Student Gender and Academic Status (Computer Experience) on Preference of CAI



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APPENDIX B

Table 4

Data for Calculating Chi-Square Statistics for the Association of Academic Status with the Frequency of Using the Computer

Groups by the frequency of using the computer

Count Expected value residual	Seldom	Sometimes	Quite often	Row Total
Undergraduate	3 1.5 1.5	19 15.5 3.5	16 21.0 -5.0	38 50.0%
Graduate	0 1.5 -1.5	12 15.5 -3.5	26 21.5 5.0	38 50.0%
Column total	3 3.9%	31 40.8%	42 55.3%	76 100.0%

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