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GENDER DIFFERENCES IN SELF-EFFICACY AND ATTITUDES TOWARD COMPUTERS

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ABSTRACT

This study is aimed to investigate gender differences regarding computer attitudes and perceived self-efficacy in the use of computers among 147 college students. At the end of a computer course, the students completed a questionnaire designed to measure self-efficacy, computer anxiety, computer liking, and computer confidence. The results revealed gender differences in perceived self-efficacy regarding completion of complex tasks in both word processing and spreadsheet software. No gender differences were found in computer attitudes or self-efficacy regarding simple computer tasks. Male students had previously had more computer experience in programming and computer games and reported that they had previously had more encouragement from parents and friends.

Gender differences with regard to perceived self-efficacy expectations and attitudes toward computers represent an important issue in the area of computer education. This may affect computer interest, enrollment for courses in the college, choice of career, and the use of computers in future work settings. Individuals who lack the requisite computer skills and confidence could be disadvantaged in a job market where computing is still an area in rapid growth.

Research in this area seems to concentrate on two dimensions, perceived self-efficacy and attitudes toward computers. Since its initial introduction, the construct of self-efficacy has gained increasing importance as a significant variable for predicting individual behavior [1, 2]. Self-efficacy is defined as the belief in one's ability to execute successfully a certain course of behavior. Research supports propositions that self-efficacy will influence the choice of whether to engage in a task, the effort expended in performing it, and the persistence shown in accomplishing it [1-7]. According to Bandura several factors affect the perception of self-efficacy. The most important source of self-efficacy is performance accomplishment. The experience of success in performing a task will increase the

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self-efficacy connected to this task [1, 2, 8, 9]. Seeing others succeed or fail is a second source of information that can affect self-efficacy [2, 10-13]. Other sources of perceived self-efficacy are verbal persuasion and emotional arousal. Verbal persuasion is a weaker source than the first two, because it does not necessarily follow from merely telling someone that he/she is able to perform a task successfully that the person will believe this to be true. Finally, the state of emotional arousal provides valuable information concerning personal competence. In general, high arousal tends to decrease perceived self-efficacy, as individuals are less likely to expect success when they are tense or anxious.

Several studies have investigated female students' choice of courses and careers, and self-efficacy has turned out to be a critical predictor. Female students have significantly lower self-efficacy than male students regarding math-related and traditionally male-dominated subjects, including computer science [14-19]. Other studies have shown strong gender differences in levels of computing self-efficacy expectations [20-24]. Murphy, Coover and Owen found that the difference in self-efficacy between women and men was highest when computers were used on an advanced level [25].

Awareness of student attitudes toward computers is another critical factor in course evaluation. Attitudes are thought to influence future behavior, and have implications for such things as the use of computers or the choice of careers. Kay [26] found that both cognitive and affective attitudes were significant predictors of commitment to the use of computers and Marcolides [27] found that computer anxiety is an important predictor of computer achievement. However, research literature presents conflicting results about the relationship of gender and computer attitudes. Raub found that gender was significantly related to computer anxiety [28]. In contrast, Loyd and Gressard [29] and Koohang [30] did not find gender to be significantly related to computer attitudes on any of three selected subscales (anxiety, confidence and liking), but Koohang [30] reports that male students scored significantly higher on computer usefulness subscale than female students did.

Chen found that men held more positive attitudes of interest in and confidence with computers, and had lower computer anxiety than women [31]. Controlling for computer experience, however, men and women responded with similar interest. These results are supported by Badagliacco who reports that when the variance associated with actual computer experience was controlled, the gender gap in computer-related attitudes and self-perceptions disappeared [32]. Loyd, Loyd, and Gressard report that female students had less computer anxiety than male students, and female student liked working with computers more than male students [33]. Rosen, Sears, and Weil report results that reveal a complex relationship between gender and attitudes toward computers [34]. Gender was not related to computer anxiety, but was significantly related to computer attitudes, with women having more negative attitudes. Levin and Gordon conclude that boys have significantly more positive affective attitudes toward computers than girls, but the major finding of their study suggests that prior computer exposure (in

particular, having a computer at home) has a stronger influence on attitudes than does gender [35]. Massoud found that male students had more positive attitudes toward computers in all the subscales measured—anxiety, confidence and liking [36]. Shashaani reports that female students have less computer interests and less self-confidence in their ability to use computers than male students [37].

An interesting framework in explaining the gender differences in attitudes toward computers is based on the process of socialization. A sex-role identity is first of all formed within the family where norms are internalized, attitudes are learned and a self-image is acquired. These behaviors are later reinforced or shaped in school and work settings where the society's basic culture is transmitted to its inhabitants. Therefore, gender differences in attitudes toward computers may be a reflection of different social experiences.

In the study of Canadian and Chinese adolescents' attitudes toward computers, Collis and Williams found significant gender differences in attitudes toward computers [38]. However, Chinese students displayed fewer gender differences. In another study Makrakis found significant differences between Japanese and Swedish students with respect to self-efficacy in computing [39]. The Swedish students exhibited a higher degree of self-efficacy about their ability to learn about computers than both gender groups in the Japanese sample. With respect to computer attitudes, Swedish boys are significantly more positive than their female peers, whereas no significant gender differences were found among the Japanese students.

These results demonstrate that socio-cultural expectations for males and females differ and may explain gender-related differences in attitudes toward computers. Turkle claims that, in general, gender differentiation is a product of the social construction that determines what models of correct behavior are given to children of each gender [40]. Elkjær investigates this relationship, and believes that generating new knowledge on gender has to be based on two premises [41]. First, that gender is a relational concept, and second that gender is a relativistic concept. The concept is formed in relation to other gendered persons and in order to understand what gender is we have to consider the concrete context in which gender exists.

The present study was designed to investigate gender differences in attitudes toward computers and perceived self-efficacy regarding simple and complex tasks in word processing and spreadsheet manipulation. The relationship between self-efficacy and attitudes, previous computing experience, ownership of a computer, encouragement from significant others, and age, were exposed.

METHOD

Subjects

The subjects were 147 undergraduate students of business administration, eighty women and sixty-seven men, who were enrolled in a compulsory introductory

computer course in a Norwegian college. The course took place in the fall of 1992/spring of 1993. The aim of the computer course was to teach the students how to use Lotus 1.2.3 (spreadsheet program) and Word Perfect. The students completed a questionnaire after the end of the computer course, but before the final exam.

Instruments

In order to measure attitudes toward computers, the *Computer Attitude Scale* (CAS) developed by Gressard and Loyd was used [42, 43]. According to Gressard and Loyd, the scale they have developed is a convenient, reliable and valid measure of computer attitudes, which can be confidently and effectively utilized in research and program evaluation contexts. CAS is a Likert-type instrument which consists of thirty statements divided into three subscales corresponding to three affective dimensions: computer anxiety, computer confidence, and computer liking. Higher score on the anxiety subscale corresponds to lower anxiety, while higher score on the Computer Confidence and the Computer Liking subscales correspond to a more positive attitude toward working with and learning about computers. Woodrow compared four computer attitude scales and concluded that each subscale of CAS was stable enough to be used separately, and that the total score gave a reliable measure of attitudes toward computers and their use [44]. However, their data suggest that CAS is two dimensional, not three dimensional as claimed. Gardener, Discenza, and Dukes compared CAS with three other computer attitude scales and recommended CAS for research if it contains subscales measuring the constructs of interest [45]. In this study both the total score and the three subscales are used. The Alpha reliability coefficient was found to be .95 (total score), .88 (Computer Anxiety), .89 (Computer Liking), and .89 (Computer Confidence).

Owen suggests that self-efficacy can easily be measured and that it can be used to assess a composite of affect, cognition and performance [46]. In order to develop an instrument, a clearly defined set of skills or behavior has to be identified. In this study twenty computing tasks were defined—ten in Word Perfect and ten in Lotus 1.2.3. They were selected on the bases of consultation with the teachers of the computer course. The tasks were divided into two groups—simple and complex.

In order to assess the strength of self-efficacy expectations, the students were asked to rate how confident they were in performing each of the twenty tasks on a five-point scale ranging from "*no confidence at all*" to "*complete confidence.*" On the basis of the mean score, three tasks in Lotus 1.2.3 and three tasks in Word Perfect were defined as complex, while three tasks in Lotus 1.2.3 and three tasks in Word Perfect was defined as simple. The Cronbach's Alpha was, respectively .83, .74, .85 and .58. Four composite variables were constructed by adding up the items in each of these four groups of variables.

For the purpose of measuring past computer experience, the subjects were asked to indicate to what extent they had worked with word processing, spreadsheet programs, programming, or computer games before attending college. In order to measure the degree of past encouragement the subjects had to rate the degree to which their decision to use computers has been influenced by parents, school teachers, and friends. In addition, the respondents were asked whether they had a computer at home before attending college, whether they have a computer at home as college students, and finally to state their age and sex.

RESULTS

A *t*-test was carried out to test gender differences with regard to computer attitudes, self-efficacy expectations, previous computer experience, and previous encouragement with regard to using computers (see Table 1). Male students had significantly less computer anxiety and higher computer confidence than female ones. There is no significant gender with respect to computer liking. However, males had significantly higher self-efficacy expectations regarding complex tasks in Word Perfect and Lotus 1.2.3, and simple tasks in Lotus 1.2.3. With regard to previous computer experience, there are no gender differences for the use of work processing software and spreadsheet programs. Male students reported, however, significantly more prior experience in programming and computer games. They also reported significantly more encouragement in the past from friends and parents, but there are no gender differences with regard to encouragements from school teachers.

Computer attitudes and perceived self-efficacy are strongly correlated. All correlations between the four self-efficacy scales and computer attitude are significant ($p < .001$), ranging from .28 to .59. The highest correlations are between computer attitude and self-efficacy in completing complex tasks (see Table 2).

More male (41%) than female students (24%) reported that they had home computers before they went to college (Chi Square, $p < .05$). As college students men still had more home computers than women, but this difference was not statistically significant.

In order to control for amount of experience and encouragement in examining gender differences in attitudes and self-efficacy, stepwise regression analyses were carried out. Gender, age, past computer experience, encouragement, and present PC-ownership were used as independent variables. All correlations among the independent variables are lower than .46—indicating that multicollinearity is not a crucial problem. The results indicate that previous computer experience and encouragement has the largest effect on computer attitudes. Encouragement from friends turns out to be the most important variable. Encouragement from parents and school teachers, gender, age, and PC-ownership had no significant effect on computer anxiety, computer confidence or computer liking (see Table 3).

Table 1. *T*-test: Gender Differences

Variables	Female Students Mean	*Sd*	Male Students Mean	*Sd*	*t*	*p*
Lotus 1.2.3						
Self-efficacy — complex tasks	8.0	3.2	10.1	3.4	3.8	.001
Self-efficacy — simple tasks	13.9	2.1	14.5	1.2	2.0	.05
Word Perfect						
Self-efficacy — complex tasks	7.6	3.0	9.3	2.9	3.6	.001
Self-efficacy — simple tasks	13.5	2.4	14.1	1.3	1.7	.09
Previous experience						
Spreadsheet	2.2	1.0	2.3	1.2	.9	.38
Word processing	2.8	1.2	3.1	1.1	1.1	.28
Programming	1.3	.8	1.9	1.0	3.4	.001
Computer games	2.0	1.1	2.8	1.1	4.4	.001
Computer attitudes						
Anxiety	47.9	7.5	51.7	6.6	3.2	.001
Liking	33.5	7.8	35.8	8.1	1.7	.095
Confidence	33.8	7.5	37.9	6.8	3.3	.001
Encouragement						
Friends	1.9	1.0	2.5	1.3	2.9	.005
Parents	1.6	.9	1.9	1.1	2.0	.05
School teachers	2.2	1.2	2.3	1.2	.8	.43
N	80		67			

Table 2. Correlation between Computer Attitudes and Self-Efficacy

Self-Efficacy	Computer Attitudes Anxiety	Liking	Confidence	Total Score
Lotus — complex tasks	.53**	.46**	.54**	.55**
Lotus — simple tasks	.37**	.39**	.39**	.41**
WP — complex tasks	.58**	.48**	.59**	.59**
WP — simple tasks	.36**	.29**	.28**	.33**

**$p < .001$

Table 3. Regression Analyses

Predictor	R^2	R^2 Change	*F* Change
Self-efficacy: Lotus 1.2.3 — Complex tasks			
Experience — programming	.13	.13	21.4***
Gender	.16	.03	7.4**
Experience — word processing	.20	.04	7.1**
PC ownership today	.22	.02	4.7*
Self-efficacy: Lotus 1.2.3 — Simple tasks			
Experience — games	.05	.05	8.1**
Experience — spreadsheet	.09	.04	5.7*
Encouragement — friends	.10	.01	4.2*
Self-efficacy: Word Perfect — Complex tasks			
Experience — word processing	.16	.16	27.5***
Experience — programming	.23	.07	14.0***
PC ownership today	.27	.04	8.8**
Gender	.29	.02	4.5*
Self-efficacy: Word Perfect — Simple tasks			
Experience — word processing	.13	.13	21.3***
Computer anxiety			
Encouragement — friends	.19	.19	32.3***
Experience — word processing	.27	.08	16.9***
Experience — games	.29	.02	5.2*
Computer liking			
Encouragement — friends	.13	.13	21.3***
Experience — word processing	.20	.07	13.4***
Experience programming	.22	.02	4.6*
Computer confidence			
Experience — programming	.18	.18	31.5***
Encouragement — friends	.26	.08	15.6***
Experience — word processing	.30	.04	9.3**
Experience — games	.32	.02	4.9*

*$p < .05$
**$p < .001$
***$p < .0001$

Several regression analyses were carried out regarding perceived self-efficacy expectations, controlling for the variables PC ownership, age, past computer experience, and encouragement. The results indicate that gender differences in perceived self-efficacy only occur with regard to complete tasks, both in Lotus 1.2.3 and Word Perfect (see Table 3). The most important predictor for explaining differences in self-efficacy with regard to complex tasks in Word Perfect is previous computer experience in word processing. With regard to complex tasks in Lotus 1.2.3, previous computer experience in programming represents the largest contribution in the regression equation. PC-ownership contributes significantly with regard to complex tasks in both Word Perfect and Lotus 1.2.3.

DISCUSSION

Several studies have shown strong gender differences in levels of computing self-efficacy expectations. This study supports these results, but indicates at the same time that gender differences are strongest with regard to complex tasks. When controlling for other variables, we find that female and male students have equal self-efficacy expectations in performing simple tasks in Word Perfect and Lotus 1.2.3. These results support the findings of Murphy, Coover, and Owen [25]. After having studied word processing and spreadsheet software for one year, there are still significant gender differences among the students.

The results of the study demonstrate that the most important predictor of computer attitudes is previous computer experience and encouragement. When controlling for these variables, we find no gender differences on any of the three CAS subscales—Computer Anxiety, Computer Confidence and Computer Liking. This supports the findings of Loyd and Gressard [42] and Koohang [30], and with regard to computer anxiety, it supports the findings of Rosen, Sears, and Weil [34]. According to Chen men tend to share knowledge and encouragement concerning computers with other men more than do women [31]. In the present study, male students receive significantly more encouragement from friends than do female students, a fact which supports these findings.

Even if computer attitudes and self-efficacy expectations are strongly correlated, it is interesting to see that previous encouragement is a more important variable in predicting computer attitudes than self-efficacy expectations. According to social learning theory, both the experience of success in performing a task and verbal persuasion will increase self-efficacy [1, 2, 8, 9]. Our results indicate that for the present study, at least encouragement from others was not a significant source of self-efficacy. An interesting question, which cannot be answered on the bases of this study, is whether computer attitudes have changed during the course and affected a change in self-efficacy. So far, the results indicate that computer attitude and self-efficacy are strongly correlated, that they represent different aspects of the personality and that gender differences are found in self-efficacy (complex tasks), and not in computer attitude.

With regard to the other variables of this study, male students report more computer experience in computer games and programming than do female students. There are no significant gender differences with respect to previous experience in word processing and spreadsheet programs. This supports the results of Vasil, Hesketh and Podd [24], and Clarke and Chambers [47], and indicates that the use of word processing software and spreadsheet programs in high school and home situations gives male and female students the same degree of experience. With regard to encouragement men receive significantly more encouragement from friends and parents than do women. Clarke and Chambers could not find any gender differences in the amount of influence from significant others—the reason may be that the perceived amount of encouragement was very low [47]. Chen found gender differences with respect to friends, but not to parents [31]. Hess and Miura found that encouragement may be given more to boys than to girls [48]. The results of my study indicate that male students are part of a social network that is more concerned about computers, and where the use of computers gives them a higher social status. Furthermore, my results seem to suggest that parents still regard computers as a male rather than a female, or common domain. Significantly more male students than female students reported having had access to a home computer before they enrolled in college. These results correspond to the findings of Vasil, Hesketh, and Podd [24] and Clarke and Chambers [47]. In spite of this fact, female students have the same degree of computer experience in word processing and spreadsheet software. This indicates that men and women have different patterns in their use of home computers, or that other computers are available.

In this study female students are found to have less self-efficacy with regard to complex computing tasks than their male counterparts, they have less computer experience in programming and computer games, they are less encouraged by friends and parents, and they have less access to a home computer. Future research is needed in order to examine how it is possible to increase female students' self-efficacy during computer courses. We need to find a way for changing the perceived self-efficacy expectations among the students. Finally, the question of whether low self-efficacy has any effect on the use of computers in a future work situation should be addressed.

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