

Computer Anxiety, Computer Experience and Self-Efficacy

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The development and increasing availability of microcomputers in recent years, has caused a re-evaluation of teaching and learning processes. Teachers and students are key users of information (Sinclair, 1993) and the capacity of the computer to process and manage this information, makes it a powerful tool for both teachers and students alike (Kozma, 1987). Given the opportunities that computers may provide, both for teachers and students, there has been a rapid increase in the number of computers in schools. This emphasis on computers, however places stress on both teachers and student teachers to learn about and use computers in everyday teaching and learning situations. Concern regarding this increased use of computers in educational contexts has arisen due to the significant number of people displaying negative reactions to

computers and low self-efficacy with regard to their abilities to use computers. Throughout the literature, these negative reactions have predominantly been referred to as "computer anxiety". McInerney, McInerney and Sinclair (1994: 28) define computer anxiety as, "an affective response of apprehension or fear of computer technology accompanied by feelings of nervousness, intimidation and hostility." McInerney et al (1994) further note that these feelings of anxiety may be accompanied by negative cognitions and attitudes towards technology, including fears about looking foolish and damaging the computer.

Much of the research investigating computer anxiety lacks any focussed theoretical framework. Bandura's (Bandura, 1986; 1988) self-efficacy theory of anxiety may however provide an appropriate framework. Bandura (1986; 1988) argues that self-efficacy acts as a mechanism underlying anxiety arousal, and that anxiety arises because people believe that they are unable to cope with potentially threatening events. Although research regarding this argument has predominantly focussed on clinical phobias, Meece, Wigfield and Eccles (1990) investigated this relationship with regard to achievement anxiety and found that students with low self-efficacy were anxious about academic demands. Applied to computer anxiety, this theory indicates that people who have low self-efficacy with regard to their computer abilities, experience computer anxiety.

Anxiety has also been found to have debilitating effects on behaviour in the form of negative thoughts. Sarason, Sarason and Pierce (1991) propose that thoughts characterised by self-doubt, are a form of anxiety. Negative thoughts have been proposed to direct attention away from the task and onto the individual's perceived inadequacies, thereby impairing performance. Several researchers (Galassi, Frierson and Sharer, 1981; Glass and Knight, 1988 and Hunsley, 1985) in both computer and test anxiety, have found that high anxious students report more negative thoughts than low anxious students.

Several correlates of computer anxiety have previously been examined, including gender and computer experience. Research examining gender has produced varied results, with several researchers reporting no gender differences in computer anxiety (Pope-Davis and Vispoel, 1993 and Glass and Knight, 1988), and others (McInerney et al, 1994 and Okenbukola, 1993) finding that females report higher computer anxiety than males. Similarly, investigations of the effects of computer experience on computer anxiety have produced varied results. Specifically, Loyd and Gressard (1984) and McInerney et al (1994) have found that computer experience is related to low computer anxiety. In contrast, King (1993) and Rosen, Sears and Weil (1987) found that a period of computer interactions increased, rather than decreased computer anxiety.

In light of these disparate results and the lack of any focussed theoretical framework, this study sought to investigate the

relationships between computer anxiety, self-efficacy, negative thoughts about computers, and their correlates. Additionally, this study aimed to examine the effects of an Introductory Computer Course on these variables.

Sample

The subjects involved in this study were 141 first year education students, 103 females and 37 males, attending the University of Sydney.

All students enrolled in the Bachelor of Education degree at this university are required to complete an Introductory Computer Course, in order to fulfil their degree requirements. At the beginning of the course, eighty-nine students regarded themselves as non computer users, fifty-seven classified themselves as novices, thirty-two regarded themselves as intermediate while three classified themselves as old hands.

Method

Measures of anxiety, self-efficacy and negative thoughts with regard to computers, were administered to a sample of 141 university students, at the beginning and conclusion of a 13 week Introductory Computer Course.

Students also provided data concerning their gender, prior computer experience and self-classification as a computer user.

Measures

Students completed three scales at the beginning and end of the Computer Course. Specifically, the students completed The Computer Anxiety Rating Scale, developed by Heinssen, Glass and Knight (1987). A 19 item scale, the Computer Anxiety Rating Scale contained two subscales, invoking information about the students' feelings of competency and anxiety, with regard to computers. Additionally, students responded to a Computer Self-Statements Scale, adapted from Galassi, Frierson and Sharer's (1981) Checklist of Positive and Negative Thoughts. This scale consisted of 21 thoughts which are proposed to occur when using computers. On a five point Likert type scale, students indicated the frequency with which these thoughts occurred. Finally, students completed the General Computer Self-Efficacy Scale, adapted from the self-efficacy component of Pintrich and De Groot's (1990) Motivated Strategies for Learning Questionnaire (MSLQ). This scale contained nine items eliciting information concerning subjects' perceived confidence and competence about performing computer tasks.

As well as these scales, students were administered demographic questions eliciting information about: gender, prior computer experience, and self-classification as a computer user.

The introductory computer course within which the students participated, was a one semester course, run one hour per week. Within this course, students were taught word processing ("MS Works"), graphics, and database management, on either IBM compatible computers or Apple Macintosh computers. This course aimed to provide students with the basic skills, and confidence for using microcomputers, both from the perspective of personal productivity and for developing an awareness of computers as an educational tool.

Procedure

All first year education students attending eleven computer tutorials were administered the Computer Anxiety Rating Scale and the Background Questions at the beginning of the first tutorial. In the second week of tutorials, subjects were administered a second questionnaire

containing a Computer Self-Statements Scale and a General Computer Self-Efficacy Scale. The questionnaires were administered over two consecutive weeks for two reasons. Firstly, by administering the Computer Self-Statements Scale and the General Computer Self-Efficacy Scale in the second week subjects who had no prior computer experience were provided with a basis upon which to judge their thoughts when using a computer and their computer efficacy. Secondly, it was necessary to keep the questionnaires short enough for the subjects to complete them without interrupting the tutorial for too long. In the eleventh week of semester, the Computer Anxiety Rating Scale and the Computer Self-Efficacy Scale were readministered to subjects in nine out of the eleven tutorials. Subjects taking part in the remaining two tutorials completed all the questionnaires during this week, due to unforeseen circumstances. All students present at the tutorial taking place in the twelfth week of semester were readministered the Computer Self-Statements Scale and the General Computer Self-Efficacy Scale in this week. Those students who did not attend either of the final tutorials completed the missing questionnaire at the conclusion of their examination, which took place in the final week of semester. During the tenth week of semester, 19 students were approached, on the basis of their moderate to high pre test responses, to participate in a fifteen to twenty minute interview. These students were interviewed, about their computer anxiety, at convenient times throughout the following three weeks.

Results

The present study had three main objectives, firstly to investigate the intercorrelations between computer self-efficacy, computer anxiety and negative thoughts with regard to computers. Secondly, to examine the correlates of computer anxiety, computer self-efficacy and negative thoughts about computers, and thirdly to investigate the effects of the introductory computer course on students computer anxiety, computer self-efficacy and negative thoughts, with regard to computer use.

Intercorrelations between Anxiety, Self-Efficacy and Negative thoughts:
Correlation procedures were used to investigate the intercorrelations between computer anxiety, self-efficacy and negative thoughts, on students' initial responses. Results from this analysis revealed that the anxiety subscale of the Computer Anxiety Rating Scale and the General Self-efficacy Scale, were significantly correlated (-.4924, $P < .001$). Significant relationships were also obtained between the competency subscale of the Computer Anxiety Rating Scale and the General Self-Efficacy Scale at (.4382, $P < .01$). A significant correlation was also found between the anxiety subscale of the Computer Anxiety Rating Scale and the Negative Thought scale (.2859, $P < .001$).

In summary, both the anxiety and competency subscales of the Computer Anxiety Rating Scale were found to be related to self-efficacy. In particular, the anxiety subscale was found to be negatively related to self-efficacy. The anxiety component of the Computer Anxiety Rating Scale was also found to be related to negative thoughts.

Differences relating to Gender:

Independent t-tests were conducted to address the research question concerning possible gender differences in computer anxiety, self-efficacy and negative thoughts. No significant gender differences were found for any of the scales administered. Similarly, no gender differences were found with respect to any of the variables regarding prior experience.

Differences relating to Prior Experience:

Within this study, data were collected about the particular variety of computer software that students had previously used, as well as students' classification of themselves as a computer user.

Computer Anxiety:

To assess the relationship of prior computer experience and computer anxiety, Analysis of Variance (ANOVA) and subsequent Student Newman Keuls multiple range tests were conducted. The analysis of variance, revealed a significant main effect for prior computer experience on the anxiety subscale of the Computer Anxiety Rating Scale: $F(4,136) = 9.1745$, $P < .01$. Student Newman Keuls follow-up comparisons revealed that for pre test anxiety, there were significant differences (.05 level) between students who had different types of prior computer experience. Specifically, students who had experience with spreadsheets ($N=14$), reported lower computer anxiety than those who had previously used databases ($N=22$), word processors ($N=38$), computer games ($N=36$), and those who had never previously used a computer ($N=36$). Additionally, those who had previously used a database reported significantly lower computer anxiety than those who had previously used a word processor. The analysis of variance conducted

on the Competency subscale of the Computer Anxiety Rating Scale and prior computer experience also revealed a significant main effect: $F(4, 136) = 3.5209$, $P < .01$. A Student Newman Keuls follow up comparison indicates that subjects who had previously used spreadsheets felt significantly more competent than those who had either never used a computer or had previously used a word processor.

Analysis of Variance procedures, also revealed a significant main effect for self classification as a computer user on both the anxiety ($F(3, 137) = 16.8350$, $P < .001$) and competency subscales ($F(3, 137) = 4.4076$, $P < .01$) of the Computer Anxiety Rating Scale. The Student Newman Keuls procedure revealed that for the anxiety subscale, subjects who classified themselves as non computer users reported significantly higher computer anxiety than those who classified themselves as novices, intermediate or old hands. For the competency subscale, the Student Newman Keuls procedure revealed that students who classified themselves as non users differed significantly from those students who classified themselves as either a novice or intermediate.

Self-Efficacy:

Analysis of Variance and Student Newman Keuls procedures were implemented to assess the effects of prior computer experience on subjects' computer self-efficacy. This analysis revealed a significant main effect for prior computer experience on Computer Self-Efficacy: $F(4, 136) = 6.7831$, $P < .001$, therefore providing support for the hypothesis that prior computer experience is related to self-efficacy. The Student Newman Keuls follow-up procedure indicates that significant self-efficacy differences were found between subjects who had different computer experience. In particular, those students who had previously used computer games, word processors, databases and spreadsheets reported significantly higher self-efficacy than those who had never used computers. Students who had previously used spreadsheets also reported higher self-efficacy than those who had previously used computer games and word processors.

Analyses further revealed that self-classification as a computer user significantly affected subjects' self-efficacy ($F(3, 137) = 13.2446$, $P < .01$). In particular, subjects who classified themselves as non users reported significantly lower self-efficacy than those students who classified themselves as either novices, intermediate or old hands.

Negative Thoughts:

Analysis of Variance and Student Newman Keuls follow up tests were performed in order to answer the research question regarding the role of prior computer experience on negative thoughts. Analyses revealed that prior computer experience significantly affected the number of negative thoughts experienced by subjects' at the beginning of the course ($F(4, 136) = 2.7942$, $P < .05$). In particular, subjects who had previously used either computer games or word processing packages,

experienced more negative thoughts than subjects who had previously used spreadsheets.

Self-classification as a computer user, however was not found to be significantly related to the frequency of negative thoughts experienced.

The Effects of The Introductory Computer Course

Effects on Anxiety, Self-Efficacy and Negative thoughts:

Means and standard deviations were computed for each subscale on the pre and post tests, and differences between means were analysed by use of paired t-tests. Analysis revealed a significant effect of the computer course on the anxiety subscale of the Computer Anxiety Ratings Scale, at the .05 level. In contrast, no significant effect was found for the computer course on the Competency subscale or the General Computer Self-Efficacy Scale. A statistically significant difference was however obtained between the pre and post tests of the Negative Thoughts Scale (see Table 1).

Table 1.T-tests for the Pre and Post Anxiety and Competency subscales of the Computer Anxiety Rating Scale, General Self-efficacy Scale & Thoughts Scale.

Variable	Pre Test	Pre Test	Post Test	Post Test	T
	Mean	SD	Mean	SD	
Anxiety	23.4752	6.163	22.6383	5.400	1.99#
Competency	31.6809	4.677	32.1613	4.782	-1.36
Self-efficacy	29.5887	5.726	29.4255	5.696	.36
Negative Thoughts	59.0355	4.940	60.4823	4.923	-3.23*

#Significant at the .05 level

*Significant at the .01 level

The Introductory Computer Course was not found to be related to significant change in the findings of either competency or self-efficacy. The Introductory Computer Course did however, significantly reduce anxiety at the .05 level. Comparison of pre and post test negative thoughts, in contrast, revealed that negative thoughts significantly increased at the conclusion of the Introductory Computer Course.

Interviews with Students

Familiarity:

The predominant finding from the interviews was that the major source of anxiety, at the beginning of the Introductory Computer Course was

due to a lack of familiarity with computers. Most, if not all students who participated in the interviews noted that their anxiety stemmed from the fact that they had never used a computer before, and therefore did not understand how to use one. Students responses regarding familiarity with computers appear below:

"I had never used a computer before and didn't know what to expect, I guess it was the fear of the unknown."

"I was probably anxious primarily because I had never used computers before, I think lack of familiarity is definitely a big factor of it."

Fear of Losing Information, Breaking the Computer etc.

A further cause of anxiety was the subjects belief that they would be able to either lose information easily or break the computer if they made a mistake. Comments of several students appear below:

"I'm cautious about saving information. Sometimes it worries me that I might lose all the information."

"I was scared that I might do something to destroy them or break them down."

Fear of Failure:

Fear of failure was a common theme expressed by most students during the interviews. Students were asked about the thoughts which went through their minds when they used the computer in the initial tutorials, to which most of the students replied that they thought about failing the course. Similarly, some students thought about escaping the situation and questioned their abilities to learn the concepts which were to be taught within the course, and indeed the necessity of such a course in education. For example:

"I was also anxious about failing the course. Just stuffing up."

"Can I get out of this."

"Is this relevant."

Feeling of Isolation (self-comparison):

Another theme which was common to the interviews with the students was a feeling of isolation. Many students noted that they felt like they were the only students who knew nothing about computers, yet in reality several other students had no experience with computers. Two students comments appear below:

"I felt like I was the only one who didn't know what to do."

"Everyone else just knew what to do and I didn't even know how to put

in the disk."

It became clear throughout the interviews that some kind of self-comparison process was taking place, with most students judging their ability to use computers by other students abilities.

Additionally, many students were worried that they may do something wrong and look stupid. For example:

"That everyone else would be better than me and I would look really stupid or something. I didn't think that I would be that bad, but I thought that others might be better."

"Am I up to the same stage as the others."

Avoidance (Coping Styles)

One student noted that she went as far as not turning up to most lecturers, because she felt dumb. Similarly, another student noted that she felt bad asking questions all the time, and as a consequence no longer asked questions.

Fear of Technology

Several students also identified the technological nature of computers to be a cause for concern. Specifically:

"(I was anxious because) I haven't had much contact with computers and just the fact that they are technological."

"I was also worried because technology scares me, because I don't understand it. I'm just not a technological person."

In fact, one student noted that she didn't think her anxiety would ever completely disappear because:

"Technology is always changing and I will never know everything about it. No matter how much I learn it's like all technology it changes and there is always something else to learn."

Summary of Results:

Results revealed that both the anxiety and competency subscales of the Computer Anxiety Rating Scale were correlated with self-efficacy, with the anxiety subscale yielding a negative correlation, and the competency subscale yielding a positive correlation. Overall analyses revealed that prior experience affected students' pre-test computer anxiety, self-efficacy and negative thoughts. Specifically, as experience increased students anxiety and negative thoughts about computers decreased and their self-efficacy with regard to their computer abilities increased. Self-classification as a computer user, was also found to be significantly related to students' feelings of anxiety, competency and self-efficacy, with regard to computers.

Analyses conducted with regard to effects of the Introductory Computer Course revealed that computer anxiety decreased, while negative thoughts increased. However, neither competency nor self-efficacy changed over the course.

The interviews revealed that the sources of students' computer anxiety varied, however the most commonly cited cause was lack of familiarity with computers. Several other sources emerged from the interviews, including fear of failure, fear of losing information and a general fear of technology. Throughout the interviews, it also became increasingly obvious that most of the students interviewed felt that they were the only person who had never used a computer before, and this appeared to arouse considerable anxiety.

Discussion:

This study had several purposes, first to investigate the relationships between anxiety, self-efficacy and negative thoughts about computers, second to examine the relationships between other previously hypothesised variables and computer anxiety, self-efficacy and negative thoughts. Third, to investigate the effects of an Introductory Computer Course on students' computer anxiety, computer self-efficacy and negative thoughts about using computers.

Interrelationships Between Computer Anxiety, Self-Efficacy and Negative Thoughts:

In the present study measures were taken of computer anxiety, general computer self-efficacy and negative thoughts. Consistent with the Self-Efficacy theory of anxiety, the present study yielded a significant negative relationship between the anxiety subscale of the Computer Anxiety Rating Scale and the self-efficacy scale, indicating that high anxiety is related to low self-efficacy. A significant positive relationship was also found between the competency subscale of the Computer Anxiety Rating Scale and self-efficacy, indicating that high competency was related to high self-efficacy. As anticipated, the anxiety subscale of the Computer Anxiety Rating Scale was also significantly related to negative thoughts. This indicates that as anxiety increased so too did the number of negative thoughts experienced, thus corroborating the findings of Galassi et al (1981) and Glass and Knight (1988).

These results support the view that the amount of anxiety aroused by computers is related to both feelings of self-efficacy and the arousal of negative thoughts about failure and inability to use a computer.

Differences relating to Prior Computer Experience:

Data regarding prior experience were collected by examining the

particular variety of software students had previously used, including none; computer games; word processing; database; or spreadsheets. Additionally, students were asked to indicate how they classified themselves as computer users.

As expected prior computer experience was found to be related to anxiety, competency, self-efficacy and negative thoughts. Additionally, computer anxiety and self-efficacy were affected by self-classification as a computer user. Generally, students who reported a broad range of computer experience reported lower computer anxiety, fewer negative thoughts and higher self-efficacy. In contrast, those students who had never used a computer before tended to experience higher anxiety, more negative thoughts and lower self-efficacy.

Presumably, previously using computers enables people to acquire computer skills and confidence which generates positive feelings about their capabilities to use computers. By acquiring these skills either in formal or informal experimentation, students become more competent with computers, and may feel that they are able to cope with the potential threat of using computers. Skills gained from previously using computers may also promote feelings of self-confidence which may therefore enable students to control the intrusion of negative thoughts about failure and inadequacy and thus concentrate on the task.

Gender:

In contrast to the findings of Chen (1986) and Okebukola (1993), the present study found no significant gender differences in students' initial computer anxiety, self-efficacy or negative thoughts. One possible explanation for these unexpected findings is that the present study found no gender differences in any of the variables regarding prior computer experience.

The Effects of The Introductory Computer Course:

The Introductory Computer Course aimed to introduce students to basic computing concepts in order to develop both an awareness of the computer as an educational tool, and to enhance students' essay

writing. The computer course covered databases and graphics, with a major focus on wordprocessing. It was expected that computer anxiety and negative thoughts would decrease, and self-efficacy would increase, as a consequence of the computer course.

Corroborating the findings of Howard et al (1987), Leso and Peck (1992) and McInerney et al (1994), the results of this study indicate that anxiety decreased over the Introductory Computer course. Interviews with a selection of students who participated in the computer course substantiate this finding. Typically, students attributed their

reduction in anxiety to the constant exposure to and increased familiarity with computers. It also became clear throughout the interviews that students felt less anxious about computers, because they had been taught computer concepts and skills throughout the computer course. Presumably, exposing students to computers, giving them quality instructions and allowing them to acquire computer skills at their own pace, reduced the threat that computers had previously held.

Surprisingly, students reported significantly more negative thoughts at the conclusion of the course. This finding indicates that although the computer course introduced students to many computing concepts, fear of failure still concerned several students. It is not unreasonable to expect that as the course progressed students became concerned about the approaching examination and therefore thought more frequently about failure. Additionally, this increase in negative thoughts may have been due to the fact that several students completed the questionnaires after the examination which, because of its nature may have prompted students to think about such things as failure, and lack of time to complete the task.

Conclusions and Implications:

Students computer anxiety, computer self-efficacy, negative thoughts and prior computer experience have been shown to be important variables which should be considered when designing a computer course. The results of this study indicate that a relationship exists between high computer anxiety and low computer self-efficacy, therefore providing some support for Bandura's self-efficacy theory of anxiety. Similarly, a relationship was found between computer anxiety, and negative thoughts, suggesting that negative thoughts about computers may play a role in computer anxiety.

The results of this study indicate that many student teachers experience anxiety, low self-efficacy and negative thoughts at the prospect of embarking upon a computer course. These results also indicate that computer anxiety, self-efficacy and negative thoughts may be a function of prior computer experience. Gender, however was not found to be a variable affecting the level of computer anxiety experienced, self-efficacy or negative thoughts.

This study also provides some support for the view that computer experience decreases computer anxiety. The Introductory Computer Course central to this study, was found to decrease anxiety. However, it must be noted that the quality of the computer experience is of paramount importance.

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