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ABSTRACT

Although the number of computers in the school system is increasing, many schools are not using computers to their capacity. One reason for this may be computer anxiety on the part of the teacher. A review of the computer anxiety literature reveals little information on the subject, and findings from previous studies suggest that basic controlled research is needed. A study was undertaken to measure computer anxiety in a college population and to determine the relationship of computer anxiety to personality types and math anxiety. Undergraduates (N=59) completed Oetting's Computer Anxiety Scale (COMPAS), A Questionnaire About Computers, the Math Anxiety Rating Scale (MARS), and the Vocational Preference Inventory to determine Holland types. Demographic data revealed that subjects had limited access to computers and only a minimal amount of computer experience. The data from both computer scales suggested mild degrees of computer anxiety. Correlation analysis for the COMPAS and MARS suggested a moderate relationship between the two instruments. An analysis of Holland types revealed that Artistic and Social types reported a significantly higher amount of computer anxiety compared to the remaining four types; there were no significant differences among the other four types. The findings suggest there is some validity to classifying people by Holland types to determine levels of computer anxiety. (NRB)

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Computer Anxiety

Relationship to Math Anxiety

and Holland Types

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Running head: Computer Anxiety

Abstract

College students (N=59) participated in an investigation of computer anxiety and its relationship to math anxiety and vocational personality types. Oetting's Computer Anxiety Scale was used to measure computer anxiety. The Math Anxiety Rating Scale and the Vocational Preference Inventory were used to measure math anxiety and vocational personality types. Descriptive correlational statistics and ANOVAs for Holland types are discussed.

Computer Anxiety:

Relationship to Math Anxiety

and Holland Types

Microcomputers are becoming a part of everyday life. Computer use in American society has increased significantly in the past few years. Since approximately 1974, microcomputers have become less expensive, easier to operate, more compact, and more feasible for public use (Rotenberg, 1983). The widespread use of computers is changing our society and may well revolutionize our world. Rotenberg (1983) reported that by 1990 one out of 10 homes will have a computer. Experts in the field have reportedly estimated that the use of computers will soon be prevalent in most areas of the work force. Turkington (1982) reported that in the next 20 years approximately 75% of U.S. jobs will require some type of computer skills. These figures suggest that computers have become a permanent part of the American lifestyle.

Associated with the rise of the computer is a growing emphasis on science and technical subjects in the elementary and secondary school systems. A recent survey revealed that approximately half of U.S. schools use computers in teaching (Corson, 1982). The Department of Education's National Center for educational Statistics (NCES) recently reported that the use of microcomputers in public schools tripled between fall 1980 and spring 1982 ("Microcomputers become student's tool", 1982). As stated by Dr. Mary White, psychologist of the Electronic Learning Laboratory of Teacher's College, Columbia University, "Schooling will never be the same, learning will never be the same, teaching will never be the same" (Turkington, 1982,p.1).

Although the number of computers in the school system is increasing, many schools are not using computers to their capacity. Some school systems, however, are putting the computers to use in creative ways. For example, one school system in New York provides microcomputers for Special Education and physically disabled students (Turkington, 1982).

Why haven't more school systems better utilized computers in the classroom? Although computer manufacturers and researchers have promised better education with computers (Bales, 1983; Offir, 1983) data indicate that most computers are used in remedial instruction and basic computer literacy courses. Corson (1982) stated that one of the difficulties with computer-assisted education is that it is "automation, not innovation" (p.1). The programs utilize new technology with traditional teaching formats. He likened the computer to "expensive flashcards" (p.1) used in the classroom rather than as a tool that could help change the traditional teaching methods of the past.

One plausible explanation for computers not being better used is the teacher's deficits regarding computer use (Bass, Brown, & Nold, 1975; Milner, 1980; Brunwelheide, 1982). Skinner (Bales, 1983) does not address this issue and states that the use of technology in teaching can be threatening to individuals. People who have not grown up with computers suffer from a "computer generation gap" in relation to younger generations that have had computers accessible for most of their lives. This "generation gap" may make individuals feel deficient in terms of computer competency and computer knowledge (Turkington, 1982; Brunwelheide, 1982). These feelings may contribute in part to the limited utilization of computers in our school systems.

Teacher Variables in School Computer Utilization

The literature in this area seems to suggest several reasons for teacher apprehension in utilizing computer-assisted instruction in the classroom. Many authors have suggested that lack of teacher training is the largest computer related problem in the educational community (Pratscher, 1981; Stimmel, Connor, McCaskill, & Durrett, 1981; Rogers, 1983; Mace, 1983). A second variable which hinders the utilization of computers in the school system is lack of teacher experience with computer related materials. Turkington (1982) reported that in the past several years computer companies have significantly increased their educational software programs available for purchase by school systems. Turkington stated that many times little or no research goes into these programs before they reach the market and that the educational value of some programs is questionable. Without adequate training and experience in the area of computerized instruction, teachers may have difficulty selecting and properly using programs for their classroom needs.

A third variable that may effect the use of computers in the classroom is computer anxiety on the part of the teacher. Turkington (1982) states "but it is not only the software which worries some educators and psychologists, but the way teachers themselves view the micros... the last thing we want them to do is take this and turn it into something manifestly dull" (p.30). Research suggests that many teachers have negative feelings about computers and computer assisted instruction in the classroom (Stimmel et al., 1981; Brunwelheide, 1982; Offir, 1983; Winer, Strauss, Lutzer, Anderson, & Ronshausen, 1983). Although negative feelings about computer use have been reported in the literature, few investigations have attempted to identify the source of these feelings. Since the area of computer science has little research in this area it may be helpful to draw upon models from related fields. One field that may yield useful analogies is mathematics, specifically the concept of math anxiety. It has been hypothesized that math anxiety may hinder an individual's ability to manipulate numbers and solve problems in academic as well as everyday life (Richardson & Suinn, 1972). This anxiety may negatively affect the person's attitudes and amount of time spent in math related activities. It is hypothesized that anxiety may also affect individuals working in the field of computers. This concept of computer anxiety may be related to negative attitudes towards computers and may reduce time individuals spend in computer related activities.

Winer et al. (1983) have offered a hypothesis why teachers may experience difficulty in the areas of mathematics and computer literacy. Winer et al. hypothesized that elementary education teachers' personality codes, according to Holland's categories, are incongruent with those required for mathematics and computer related fields. This incongruence increases the likelihood of a great dislike of these fields and difficulty learning in these areas. These individuals, theoretically, would be dissatisfied in a teaching situation requiring computer related skills. The authors suggested that according to the Holland theory, individuals whose personalities are incongruent with their environment have a greater probability of seeking alternative vocations where they may find more congruence in their occupational choice. Thus the problem of finding computer-literate teachers would become chronic as those teachers who like computers leave the classroom for more computer-oriented environments such as business and as those teachers who dislike computers leave the computerized classroom.

Review of the Literature Related to Computer Anxiety

A review of the computer anxiety literature reveals little information on the subject of computer anxiety. A literature review article by Brumelheide (1982) was written to summarize recent articles dealing with teacher competency with microcomputers in the classroom. Dr. Brumwelheide reported that the majority of articles published deal with the concept of computer literacy in the classroom. In her review of sixteen articles, the concept of attitudes toward computers or computer anxiety was not addressed. This indicates that although there is scholarly interest in how teachers are adjusting to the use of computers in the classroom, there is little emphasis on subjective views and attitudes surrounding these issues.

Offir published an article in 1983 that emphasized that teachers' opinions toward computers in the classroom setting may be discrepant from their willingness to actually use computers in their own classroom. The goal of Offir's study was to analyze the attitudes on instructors in a college physiology course towards the use of computers to aid in classroom instruction. Data were gathered by observation, formal and informal interviews, and questionnaires. In interviews with professors "all...showed a positive attitude toward using the computer in the process of teaching physiology" (p.26). After these interviews were conducted, computer programs were written for the physiology classes according to the professor's comments and each professor had an opportunity to alter the program after it was developed to better fit the goals of the class. Although all of the professors had indicated positive attitudes of computers in the classroom, none of the professors chose to use the computer programs in their courses.

Offir's study shows the discrepancy between teachers' ideas on computer use in a classroom vs. computer use in their classroom. Although Offir did not speculate as to the reasons behind this discrepancy, he hypothesized that this discrepancy can influence how computers are utilized as well as the student's attitudes toward computers in the classroom.

A study by Stimmel et al. (1981) addressed more directly teacher's negative attitudes toward computers and the computer's relation to the fields of mathematics and science. The goal of their study was to analyze affective attitudes of teachers toward computers, computer-aided instruction, and the fields and teaching of mathematics and science. A semantic differential was given to the teachers. They were asked to rate each of the variables according to the 25 bipolar adjectives on the semantic differential scale. Factor analysis was then computed on each variable to determine its principle loadings. The results indicated strong negative affect for all of the variables, primarily computers, computer aided instruction, mathematics, and teaching mathematics. Stimmel et al. concluded that more positive aspects should be presented to student teachers when they are learning how to utilize computers for classroom use.

A study by Ronshausen, Winer, Lutzer, Walling, Anderson, and Strauss (unpublished manuscript) attempted to directly measure computer anxiety and math anxiety. The authors developed a course at Texas Tech University for elementary education majors specializing in mathematics education. The goals of the course were to increase student's mathematics skills and to develop computer literacy as well as decrease math anxiety. An in-house questionnaire was developed to measure computer anxiety. Students were administered these questionnaires prior to the beginning of the course and after completion of the course. Factor analysis was also completed on the computer anxiety questionnaire.

Factor analysis revealed three factor loadings for the computer anxiety questionnaire: Positive Effect of Computers on People (Factor I), Negative Effects of Computers on People (Factor II), and Negative Effects of Computers on Society (Factor III). Results revealed low anxiety for Factor I whereas there was some anxiety reported on Factors II and III. Students showed statistically significant decreases in computer anxiety, pretest to posttest, on Factor II (Negative Effects of Computers on People). These changes primarily occurred in a group which had significantly less mathematics background than the other groups.

Oetting (1983) has developed a scale specifically designed to measure computer anxiety, the Computer Anxiety Scale (COMPAS). COMPAS consists of 48 items (10 items for the short form). These items describe situations in which a person would be interacting with a computer. Subjects are asked to rate their subjective feelings of anxiety on a Likert-type scale consisting of five choices (strong positive feelings on one extreme and strong negative feelings on the other). The COMPAS items are divided into seven subscales (hand calculator, trust, general attitude, data entry, word processing, business operations, and computer science). These subscales can be evaluated to obtain a better understanding of an individual's areas of anxiety when dealing with computers. Scores on the COMPAS can be interpreted in relation to the Likert-type ratings since mean values can be obtained for the scale. These ratings can be compared within each scale for an individual. Oetting also has provided a normative table based on a college population (N=482) on which to evaluate scores. Oetting reported that for the COMPAS he has found no significant differences with respect to gender. Because of this, normative data are pooled according to sex. Oetting also investigated the relationship between computer anxiety and math anxiety. Having given the COMPAS and a Suinn Math Anxiety Rating Scale (MARS) (Suinn, 1972) to 279 college sophomores, he reported a correlation of .40 between the two instruments. He concluded that even though computer and math anxiety seem to be related, the COMPAS is not measuring math anxiety.

Critique of Studies on Computer Anxiety

Findings from previous studies suggest basic controlled research is needed in the area of computer anxiety. Although much has been published in the area of computer use and computer literacy, few studies have directly dealt with the concept of computer anxiety. Stimmel et al. (1981) reported negative affect towards computers as well as anecdotal evidence that suggests teachers may have anxiety about computers; however, the concept of computer anxiety is never addressed. Offir (1983) reports a discrepancy between teacher's thoughts and actions in computer use in the classroom but does not relate this with an affective process.

A second methodological problem is that there are no consistent measures reported in the literature to measure computer anxiety. Stimmel et al. (1981) used a semantic differential scale to measure attitudes while others have used their own questionnaires to measure attitudes towards computers (Reece & Gable, 1982; Ronshausen et al., unpublished manuscript). Because of this problem, a clear definition of computer anxiety has not been achieved, and it has been difficult to generalize results across studies.

Another difficulty with present research on computer anxiety is that other personal variables have not been taken into account. It is hypothesized that not all individuals have the same level of computer anxiety and that these differences may be related to identifiable variables. There is a need to know which sections of the population or what type of individuals will be more likely to experience computer anxiety. This question has not been addressed in the literature.

Lastly, it seems that the relationship between math anxiety and computer anxiety should be investigated further. Researchers have reported that there is a relationship between these variables (Stimmel et al., 1981; Winer et al., 1983). Oetting (1983) currently is the only researcher who has reported a correlation coefficient indicating the strenth of the relationship between the concepts (r=.40). There is a literature investigating math anxiety and treatments to help decrease math anxiety. If there is a relationship between the two concepts, researchers in the field of computer anxiety may be able to build on existing literature in the area of math anxiety to help answer fundamental questions. At the present time, the strength of this relationship is unclear.

Rationale and Hypotheses for the Current Study

This study measured computer anxiety in a college population and determined its relationship to personality types and math anxiety. Several questions were asked for each of these three areas. Because of the small amount of prior research in this area, few formal hypotheses were formulated. Much of the study was descriptive with respect to these variables in hopes of better understanding the concept of computer anxiety.

The first area, computer anxiety, was assessed by the COMPAS and Ronshausen et al.'s scale "A Questionnaire about Computers" (QAC). The Oetting Computer Anxiety Scale (COMPAS) was used since this instrument has been shown to have good internal consistency (Alpha=.88-.93), and face and content validity. This instrument has also been normed on a college population which allows for comparisons to individuals outside of this study. Similarly, that the QAC has been used previously on college populations allows us to compare prior results to our population and to the COMPAS.

Three basic questions were asked with regards to computer anxiety. Question one dealt with normative data on the COMPAS and QAC. The study's results were analyzed to determine if the parameters correspond to the prior results of the QAC and Oetting's normative sample. Because no other studies using the COMPAS or QAC were found in the literature, there were no formal hypotheses regarding the likelihood of these parameters corresponding to the norms. Another question asked was if there is a gender difference in computer anxiety. Oetting reports no significant difference; however, no other study could be found to prove or disprove this hypothesis. Because of this lack of research, no formal hypothesis was posed concerning gender differences. The subscales of the COMPAS were also analyzed to determine if certain aspects of computer use generate more anxiety than others. Again, no pertinent research could be found so no hypotheses were posed regarding subscale results.

A second area of research is the relationship between computer anxiety and math anxiety. Suinn's Math Anxiety Rating Scale (MARS) was the instrument used to yield the math anxiety score. Of several instruments in print to assess math anxiety, the MARS has been shown to have the greatest amount of psychometric reliability and validity (Richardson & Woolfolk, 1980; Dew, Galassi, & Galassi, 1983). In this study, MARS scores were compared according to gender to determine if there were significant differences. Because of the discrepancy in the literature. no hypothesis was posed regarding gender differences. Another question is the relationship between math anxiety and computer anxiety. Correlation coefficients were obtained for the sample population as a whole. It was hypothesized that a moderate relationship exists between the two anxiety variables.

Another area of interest is how computer anxiety is related to personality types. The classification of participants for this phase of the investigation was based on the personality theory of John Holland (1973). This system of classification was utilized for several reasons. Holland's theory is based on an assumption of normal rather than abnormal behavior. Holland's theory is associated with vocational aspects of personality and is also associated with several well normed assessment batteries. The Vocational Preference Inventory (VPI) (Holland, 1978) was used to classify individuals according to personality types. COMPAS scores were compared between Holland types to determine if there were significant differences between personality types. It was hypothesized that individuals with Investigative and Conventional VPI codes would report less computer anxiety than would individuals of other codes. These personality types are the ones most often associated with computer-related occupations in listings of occupations by Holland type.

METHOD

Subjects

Subjects for this study were 59 undergraduate students enrolled in an Introductory Psychology class at Texas Tech University. This population rather than education majors or teachers was chosen for several reasons: 1) this initial study is primarily descriptive and will be more useful if a more generalized population is measured, 2) there are normative data for the instruments to be used based on general college populations, 3) there is a decreased likelihood of obtaining all Holland types from a more constricted sample.

Several demographic variables were obtained from this sample. They include the following: age, sex, race, major and minor subjects, number of mathematics courses and associated grade point average, number of computer courses and associated grade point average, amount of access to computers, and amount of computer experience. These results are summarized in Table 1.

Insert Table 1 about here

Measures

Four measures were used in this study. Oetting's Computer Anxiety Scale (COMPAS) was one instrument used. As presented previously, this is a 48 item Likert-type scale. A global score as well as seven subscale scores can be obtained from this scale. High scores represent high anxiety about computer related issues. Internal consistency for the COMPAS is .88-.93 as measured by Cronbach's alpha coefficient.

"A Questionnaire about Computers" (QAC) was the other computer anxiety instrument used in this study. This instrument yields three scores corresponding to Factor I, Factor II, and Factor III. On Factor I (Positive effects of computers on people) a high score indicates high anxiety. Because of the wording of the items, the interpretation of scores on Factors II and III are opposite. Low scores on Factor II (negative effects of computers on people) and Factor III (negative effects of computers on society) indicate high anxiety. This questionnarie has a split half reliability of .70.

The Math Anxiety Rating Scale (MARS) is a 98 item self rating scale used to measure math anxiety. Test-retest reliability after two weeks was .78 for this instrument. High MARS scores correspond to higher reported math anxiety.

The Vocational Preference Inventory (VPI) was given to the students to determine their Holland type. Profiles (scale scores) of the six Holland types were utilized. Students were also classified into so-called "pure" types according to their highest score on the VPI. Retest reliabilities for this instrument range from .54 to .80 for a three month interval.

Procedure

Individuals were given the opportunity to participate in this study in conjunction with their class requirements. Although extra points were given to individuals, participation was voluntary. Students were asked to complete the demographic data sheet and the four instruments described above. Data collection was completed in one session for all individuals. Approximately 80 individuals were administered the test batteries. The investigators attempted to obtain five male and five female students for each of the six Holland types. For Holland types that had more than five students of a given gender, five were randomly selected from the subgroup. All but one Holland subgroup (Social male) in the final sample contained five individuals per cell. Data analysis was completed on this final sample of 59 students.

RESULTS

Data from the demographic sheet and the four questionnaires were used to evaluate the hypotheses posed for this study. Demographic data revealed that on the average this sample had limited access to computers and only a minimal amount of computer experience. The majority of students had not taken a computer science course in college. For the 12 students who had taken computer courses, the average grade was 2.70 on a 4-point scale. Forty-two of the subjects reported they had taken mathematics courses (mean number of courses was 1.5). The average grade for mathematics courses was 2.5. The ranges for the number of computer and math courses taken were 0-2 and 0-6 respectively. Other demographic data are presented in Table 1.

The first set of hypotheses dealt with computer anxiety. Since the COMPAS is a relatively new instrument, this group's COMPAS parameters were analyzed to determine if they corresponded to Oetting's normative group. All of our COMPAS mean results were higher than the normative group's scores. The global COMPAS score was 109 (s.d.=36.0) which is in the 72nd percentile compared to the normative group. Four of the seven subscales (general attitude, word processing, business operations, and computer science) were within the normal range of the normative group yet slightly above average. The remaining subscales (hand calculators, trust of computers, data entry) were above average indicating a mild degree of anxiety. None of the scales revealed a moderate or high degree of computer anxiety. Since Oetting did not report standard deviations for his normative groups, it is impossible to compare this aspect of the COMPAS. Subscale standard deviations from this group range from 3.58 (general attitude) to 10.20 (trust of computers).

Oetting also presented a correlation matrix for the seven subscales. He reported that these correlations are all positive indicating a common trait underlying these subscales. He also reported that the last five scales are substantially correlated suggesting they can be combined to yield a global computer anxiety score. The present sample's correlation matirix yielded two negative correlations. Fifteen of the 21 intercorrelations reach statistical significance. Matrices are summarized in Table 2.

Insert Table 2 about here

The results of the QAC were consistent with those of the COMPAS in that both suggested mild degrees of computer anxiety. Factor scores for the original QAC study revealed somewhat low computer anxiety scores. Results for Factor I in this study yielded a moderate amount of anxiety regarding the positive effects of computers on people. A mild degree of anxiety was reported for negative effects of computers on people (Factor II) and society (Factor III). An intercorrelation matrix reveals Factor I is significantly correlated in the appropriate direction with Factors II and III. Factors I and II are also significantly correlated with the COMPAS (see Table 2).

Another hypothesis related to computer anxiety was gender differences on the COMPAS. Oetting reported no significant differences between males and females in his sample. A t-test on this study's data supports Oetting's findings. No significant gender differences were found for the global score or seven subscale scores of the COMPAS.

This study also investigated math anxiety and the relationship of math anxiety and computer anxiety. The mean score for the MARS was 208. This result is below the normative group's average (215) indicating a slightly lower amount of math anxiety. When comparing mean results by gender, however, this sample obtained higher computer scores as compared to gender norms. Females in this study obtained a mean score of 232, and males obtained a mean score of 184. Norms for females and males are 193 and 158 respectively. A t-test revealed a significant difference in MARS scores for males and females ($t=-3.46$, $p<.001$). Some past studies on math anxiety have found no gender differences while others have found significant differences between males and females. Because of these inconsistent results, no hypothesis was posed concerning gender differences on the MARS.

Oetting's research revealed a moderate relationship between the COMPAS and the MARS ($r=.40$). Data from the present study were consistent with Oetting's findings. Correlation analysis for the COMPAS and MARS yielded a Pearson r of .39. This suggests a moderate relationship between these two instruments.

The final area this study examined was computer anxiety as related to the Holland types as mesured by the VPI. Preliminary data analysis revealed that this sample's overall VPI norms were consistent with national norms. Simple t-tests were performed on each group of "pure" Holland type to check for gender differences. There was a significant difference between males and females classified as Social types ($t-2.35$, $p<.02$). Results show that on the average females in this catagory scored significantly higher on this scale than males. There were no significant differences on the other five scales.

As with the other data in this study, a correlation matrix between the Holland types and remaining variables was computed. Correlational data revealed significant results consistently for the Realistic, Social, and Artistic Holland types. For the Realistic individual, correlates included more mathematical courses ($r=.25, p<.06$), more computer courses ($r=.38, p<.01$), less anxiety on the computer science subscale of the COMPAS ($r=-.35$, $p<.01$), and a positive correlation with age ($r=.46$, $p<.001$). The Artistic type revealed significant negative correlates with the number of math courses taken ($r=-.28$, $p<.05$), and computer grade point average ($r=-.26, p<.05$). Likewise, the Social type also obtained correlations indicating difficulties with computer and math related areas. Significant correlations were found for math anxiety ($r=.34$, $p<.01$), Factor III ($r-.27$, $p<.05$), and general attitude toward computers ($r=.36$, $p<.01$). Artistic and Social types both obtained significant negative correlations with the number of computer courses taken ($r=-.26$, $p<.05$ and $-.27$, $p<.01$) respectively. These results reveal that Realistic types have a tendancy to be more involved with math and computer classes while Artistic and Social types report more negative attitudes towards computers and math.

Analysis of significant differences between Holland types supported the correlation results reported above. It was hypothesized that there would be significant differences between Holland types with Investigative and Conventional individuals displaying the least amount of computer anxiety. An ANOVA revealed significant differences in COMPAS scores obtained by the groups ($F=2.34$, $p<.05$). Artistic and Social types reported a significantly higher amount of computer anxiety as compared to the remaining four groups. Significant differences were not found among the other four groups. Means scores for each Holland type are presented in Table 3.

Insert Table 3 about here

DISCUSSION

There are some variables that limit the generalizability of this study. One variable is the population studied. One cannot assume that results for college undergraduates will be the same for teachers in the school system. Norms need to be established for more reference groups so this type of direct investigation can occur. Another variable is the subgroup of Realistic Holland types obtained in this study. By definition Realistic types are practical, mechanically oriented, and have low interest in arts and people oriented jobs. Occupations in this category include mechanics, forest rangers, mechanical engineers, and the like. Since this was a college population, the range of Realistic interests was greatly constricted. Of the 10 Realistic students, 4 were engineering majors and one each majored in architecture, business, music education, and pharmacy. Three were undecided. This group of students may be more representative of the college Realistic type than the Realistic type in general.

Another issue is the relatively mild degree of computer anxiety reported for this sample. This is the second study at Texas Tech University to report low/mild computer anxiety. Further investigations are needed to determine if these results are consistent for populations with more severe reported computer anxiety. Another related question is how prevalent is computer anxiety in the population? Is it limited to certain subgroups in our society or is it a more pervasive phenomenon? Our study suggests that college students as a whole do not experience a great deal of computer anxiety. More anxiety is reported among subgroups that are typified as being more creative, expressive, and unconventional. Computers may limit the creativity of this type of individual. VPI types other than Social did not significantly differ in their amount of computer anxiety. It may be that individuals are beginning to view computers as tools (like adding machines) rather than as objects used to help generate scientific information. As computers become more user friendly there may be a decrease in computer anxiety.

This study also shows that more cross validation of existing scales needs to be completed. The norms for our sample were similar to norms on the COMPAS, QAC, and MARS but were not equivalent. If computers are not phenomena that generate high amounts of anxiety, the instruments need to be refined to better measure smaller differences. More research also needs to be done within subscales of these tests. In our study the COMPAS was highly correlated to Factor I of the QAC. Does this mean there are different subtypes of computer anxiety our instruments are not differentiating? If there are separate factors or subtypes of computer anxiety, researchers need to be able to revise their instruments so they are adequately measuring these different subtypes.

The results of this study suggest that there is some validity to classifying people by Holland types to determine levels of computer anxiety. Most Holland types, however, did not significantly differ in their level of computer anxiety. Further research is needed to determine which high points or profile clusters are most useful in predicting computer anxiety in certain individuals.

Students in this study did show different levels of computer anxiety as measured by Holland types. Research has shown that there are different correlates for each of the six personality types. These correlates may influence the individual's perceptions of computers, hence, their level of computer anxiety may be better understood by more investigation of these related variables. Implications for intervention may be better understood also as this type of data is utilized.

The computer anxiety scales and the MARS suggest there is a relationship between these two variables. Math anxiety has been more thoroughly researched and techniques have been devised to help decrease math anxiety in individuals. This may b an adequate model from which to begin to generate similar techniques to help decrease computer anxiety. As other related variables are found, a more comprehensive picture of computer anxiety and means of treatment can be determined.

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Table 1

Demographic and Summary Data

Variable	Mean	Standard deviation
Age	19.80	1.81
Number of math courses	1.56	1.28
Math GPA	2.53	.88
Number of computer courses	.29	.56
Computer GPA	2.70	.91
MARS	208.00	57.46
Factor I QAC	13.08	9.61
Factor II QAC	16.72	3.11
Factor III QAC	10.87	2.43
COMPAS	109.77	36.00
COMPAS Subscales:		
Hand Calculator	6.41	5.16
Trust	9.03	10.20
General Attitude	8.08	3.58
Data Entry	10.01	3.70
Word Processing	9.34	4.48
Business Operations	9.72	4.40
Computer Science	13.67	4.23

Table 2

Intercorrelation Matrices for Computer Questionnaires

COMPAS Subscales

	HC	T	GA	DE	WP	BO	CS
HC		.88**	.08	.53**	.68**	.68**	.003
T			-.06	.51**	.71**	.69**	-.05
GA				.41**	.27**	.27**	.60*
DE					.65**	.67**	.23
WP						.80**	.20
BO							.43**

*p<.05
**p<.01

COMPAS (global) and QAC

	II	III	COMPAS
Factor I	-.32	.49**	.70**
Factor II		.19	-.41**
Factor III			.25

*p<.05
**p<.01

Table 3

Mean COMPAS Scores for Holland Types

Variable	Mean
Realistic	91.40
Investigative	107.30
Artistic	132.50
Social	130.50
Enterprising	99.40
Conventional	101.70
Total Sample	109.77