DOCUMENT RESUME

ED 432 349 JC 990 489

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TITLE A Comparison between Male and Female Mathematics Anxiety at a Community College.
PUB DATE 1998-04-00
NOTE 62p.; Master's Thesis, Central Connecticut State University.
PUB TYPE Dissertations/Theses - Masters Theses (042)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Anxiety; Comparative Analysis; Mathematical Aptitude; Mathematics; *Mathematics Anxiety; *Mathematics Skills; *Sex Differences; Sex Stereotypes; *Student Attitudes; Two Year Colleges

ABSTRACT

This study was performed using a convenience sample of 90 students at a northeastern community college to determine gender differences of math anxiety and its effect on math avoidance. Four sections of an introductory English class were given a mathematics anxiety rating scale (MARS) and a math avoidance survey. Five hypotheses were analyzed using both standard normal distribution tests and chi-square contingency tables. It was determined that men reported significantly less math anxiety and sought significantly less help with math than women. Men and women were equal in avoiding taking required math courses. Women avoided majors requiring two or math courses, significantly more than men. Perception of math difficulty was not associated with math anxiety. Although there were few participants with both high levels of math anxiety and math avoidance, inspection of scatter diagrams suggest that men with high MARS scores and women of all MARS scores are at risk to avoid math courses. It is concluded that MARS represents a moderately useful measure for school professionals to predict men's math avoidance, and to a lesser degree women's math avoidance. Literature suggests that societal norms may be more influential than math anxiety in explaining women's math avoidance. This document contains thirty-nine references and two appendices, which include sample surveys and supplemental data tables. (Author/TGO)

A Comparison Between Male and Female Mathematics Anxiety at a Community College

Thomas Ruben

An Abstract of a Thesis

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

Central Connecticut State University

New Britain, Connecticut

Thesis Advisor: Timothy V. Craine, Ph.D.

Department of Mathematics

April, 1998

Abstract

A study was performed using a convenience sample of 90 students at a northeastern community college to determine gender differences of math anxiety and its effect on math avoidance. Four sections of an introductory English class were given a mathematics anxiety rating scale (MARS) and a math avoidance survey. Five hypotheses were analyzed using both standard normal distribution tests and chi-square contingency tables. It was determined that men reported significantly less math anxiety and sought significantly less help with math than women. Men and women were equivalent in avoiding taking required math courses. Women avoided majors requiring two or more math courses, significantly more than men. Perception of math difficulty was not associated with math anxiety. Although there were few participants with both high levels of math anxiety and math avoidance, inspection of scatter diagrams suggest that men with high MARS scores and women of all MARS scores are at risk to avoid math courses. It is concluded that the MARS, represents a moderately useful measure for school professionals to predict men's math avoidance, and to a lesser degree women's math avoidance. Literature suggests that societal norms may be more influential than math anxiety in explaining women's math avoidance.

Acknowledgments

I would like to thank Dr. Carole Shmurak and Dr. Philip Halloran for reviewing my work. I am especially grateful to my advisor Dr. Timothy Craine for his patience and guidance in keeping me focused on the necessary steps to complete this finished work.

I would also like to thank Betsy Sharp, Director of the Arts and Humanities Department at Naugatuck Valley Community Technical College, and her teachers Joseph Decicco and Geraldine Pelegano for allowing me to collect data from their classes.

In addition, I am greatly appreciative of the participating students at Naugatuck Valley Community Technical College for their interest and cooperation in completing the surveys I gave.

Lastly, I am particularly grateful to my wife, Amy Ruben, for her understanding and belief in this project.

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Purpose

The measurement of mathematics anxiety has drawn considerable attention over the last three decades. Much of the early research concentrated on women's anxiety and avoidance of mathematics. With the growing number of women entering typically male dominated fields, however, the difference in participation in math has decreased substantially. Although women still report their anxiety much more frequently than men, they are more inclined to seek treatment. Various studies have reported substantial numbers of college students suffering from a fear of math. Betz (1978) found that one-half of college students enrolled in a review of high school algebra responded with high levels of anxiety.

Despite the large number of math anxious students, Llabre and Suarez (1984) found math anxiety had little to do with course grades of college students after controlling for math aptitude. Why, then, the interest in math anxiety? Like the broader construct of anxiety in general, math anxiety often results in self defeating behaviors and avoidance. Thus, many students, both male and female, choose education and career goals that minimize their contact with mathematics. By comparing the relation of math anxiety with avoidance it may be determined at what level of anxiety students become at risk for avoiding math. The purpose of this study is to examine the ways in which males and females deal with their math fears. Five hypotheses will be used to investigate math anxiety and its relation to math avoidance.

In a community college setting, this study hypothesizes that: One, males are less likely to report their math anxiety than females; Two, males are less likely to seek help with math; Three, males are just as likely as females to avoid taking required math courses; Fourth, males avoid programs of study requiring math as frequently as females; and Fifth, student perception of math difficulty is related to math anxiety.

Literature Review

Introduction

In an attempt to fully understand math anxiety and the related subject of math avoidance, social mores in relationship to math participation will be reviewed. The review of literature will show the history of math anxiety beginning with a focus on differences of ability based on gender through a discussion of course taking styles and explaining avoidance and achievement. While some researchers have long viewed societal norms as influential in the study of math anxiety and avoidance (Sells, 1973; Tobias, 1976; Eccles et al., 1985), only recently has more credence been placed in this research due to the dismissal of past notions of math difficulty for females. Recently, the focus has shifted to avoidance of math, based on perceived societal values of masculine and feminine roles within the classroom. Females tend to be motivated by personal satisfaction and altruistic pursuits, whereas males respond more favorably to competitive environments (Seymour, 1995). It has been an unspoken rule that the American educational system has perpetuated that males are more able and welcome in the field of mathematics. To excel and graduate into careers in math related fields, females have often been placed in a dilemma: how to maintain their sense of selves and be accepted by their male peers.

Gender Differences in Math Ability

Prior to the coining of the phrase "math anxiety" by Tobias (1976), researchers described difficulties with math in terms of ability or inability. Males were seen as innately more able to perform math in general. Maccoby & Jacklin (1974) concluded that beginning in adolescence boys were superior to girls in mathematical performance. Hyde (1981) examined Maccoby & Jacklin's 1974 results, and found that only 1% of the variance of achievement could be explained by differences in math ability. Later, studies began to concentrate on aspects of cognitive development such as spatial ability, again qualifying women as less able. Examining the effects, Hyde (1981) found that only 4.5% of the variance of math performance could be explained by differences in spatial ability. More recent analyses have also discounted the association between spatial ability and achievement (Meece et. al., 1982; Linn & Petersen, 1983). Although males have been found to be stronger in mental rotation and tests of horizontality-verticality, evidence suggests that training can significantly alter the performance of women and men (Connor, Schackman, & Serbin, 1978; Newcombe, Bandura, & Taylor, 1983). Also, male and female child-rearing practices may explain differences in spatial and rotational abilities, as boys have typically been introduced to mechanical activities such as sports and building more than females.

Math Preparation

Sells (1973) attempted to explain college math achievement in terms of "math avoidance," suggesting that women were not as prepared as males from their high school math. Sells (1973) took a random sample of entering freshman at the University of California and found 57% of the males had taken four years of high school math and only 8% of females were similarly prepared. In a study examining precocious adolescents, Benbow & Stanley (1982) found that males and females were similar in their rates of taking math up through trigonometry and then began to differ in taking college algebra, analytic geometry, and calculus. Although males still lead females in taking more than three years of college preparatory math in high school, males and females take Geometry and Algebra 2 at equal rates. This is consistent with findings from this study.

Attrition From College Math Majors

With achievement gaps closing and math and science enrollments becoming more equal, attention has shifted to the still high attrition rate of females from college math and science programs. Surprisingly, Benbow & Stanley (1982), in a study of high achieving math students, found that more females than males intended to major in the mathematical sciences, males 15%, females 17%. Somehow though, early interest in college math does not translate to equal fruition rates among males and females. In a three-year ethnographic interview study conducted at several universities both private and public, Seymour (1995) found that high achieving females reported an inability to meld within the social milieu surrounding science, math, and engineering (SME). Rather than compromise their achievement, females reported having to expend extra effort in competing with males to prove equal math ability. These same high achieving females reported being labeled as non-feminine and undesirable by males. Thus, a conflict has been created in math between doing well while maintaining female attributes. Males on the other hand, were found to be less bothered by the competition and individual work required of the initiation process into the math and science hierarchy. In Seymour's study, excelling college females were accustomed to praise and recognition in high school and found the lack of support from teachers and peers to be disarming in their efforts to meld. Consequently, high achieving females in SME majors often switch to more humanitarian and personally satisfying majors such as the human sciences (Seymour, 1995).

Influences on Math Anxiety

Psychologists believe early socialization and later life experiences are critical in determining attitudes and anxiety. Many female college students, particularly older ones, report a variety of reasons for their fear of math. Among their reasons are: lack of female role models in teachers and work, negative teachers' feedback for incorrect responses, discouragement from pursuing math as a serious study, numeracy as rigid and task oriented, lack of discussion, and lack of parental support. Alexander & Martray (1989) reported that students with mothers having education past high school or professional fathers had significantly less math anxiety than students whose mothers had no post secondary education or fathers who were laborers. In 1985, Eccles et al. concluded that parents perceived their daughters to need extra effort to do well in math. Although no difference was found in course plans based on this finding, attribution theory suggests that females continue to believe their success is related to effort and not ability.

Attributions

Typically, females attribute their success in math to effort, and failure to lack of ability (Wolleat et al., 1980). The reverse is true for males; they attribute their success to ability and failure to a lack of effort. Cramer and Oshima (1992) found that by 9th grade gifted females developed self defeating beliefs regarding their math performance. These negative beliefs seem to originate in early mathematics learning. Math instruction during adolescence contributes to frustration by stressing mastery of standard algorithms and correctness of answers. A lack of exploration and discussion is often viewed as dogmatic and not relevant to the young student's, particularly female's, needs. Thus, females may view performance in terms of speed, lack of error, and individual mental work. Prawat and Anderson suggested that males are used to criticism due to discipline over classroom misbehavior and so do not evaluate themselves as harshly as females for giving incorrect answers (1994).

Attitudes

Attitudes, then, concerning mathematics and ability appear to be developed early in schooling. In a study of fourth and fifth graders performing mathematics in a traditional setting, Prawat and Anderson found that 44% of anxiety responses were preceded by an inability to answer correctly or complete assigned work (1994). Fennema and Sherman (1976) theorized that math anxiety was among eight other attitude domains that related to the learning of math. The Fennema-Sherman Mathematics Attitudes Scales consist of: Attitude toward Success in Mathematics, Mathematics as a Male Domain Scale, Mother/Father, Teacher, Confidence in Learning Mathematics, Mathematics Anxiety, Effectance Motivation in Mathematics, and Mathematics Usefulness (1976). The same authors concluded in 1977, that boys generally reported significantly more positive attitudes toward math than did high school girls. Hembree (1990) conducted a meta-analysis of 151 studies and concluded that positive attitudes toward mathematics consistently related to lower mathematics anxiety.

Tobias has commented extensively on women's higher anxiety levels due to societal norms and negative teacher interaction (1976). Contrary to Tobias' contention that math anxiety results from a culture that perceives math ability as a male attribute, Rounds and Hendel (1980), in a study of female highly anxious college students, failed to find a link between math anxiety and results reported from the administration of the Fenemma-Sherman Math as a Male Domain (MD) subscale. Llabre and Suarez found that college women scored significantly lower than males on an administration of the MD subscale (1985). This supports the earlier finding that although women are willing to consider themselves mathematicians, males perceive math ability as not feminine. This implies that females have modified their view of gender roles to a greater extent than males.

Stodolsky (1988) identified cognitive challenge, complexity and peer feedback as factors relating to positive student responses. Positive attitude correlates with reduced anxiety. Hembree listed enjoyment of mathematics as a -.75 correlation with math anxiety among 5th through 12th graders and -.47 for college students (1990). He also found self-concept correlated -.71 with math anxiety among a mix of grades. As mentioned earlier, females may form negative self-concepts in inflexible learning environments and so are particularly at risk for anxiety and frustration.

In an experimental mathematics program incorporating themes expressed in reform literature (NCTM, 1989), Cobb, Yackel and Wood reported greatly increased positive attitudes (1989). Conceptual and procedural knowledge was taught in tandem. Instruction was based on problem situations, with elementary school children working in pairs or groups of three. Students were free to ask questions, make mistakes and explore mathematical ideas. The same authors were unable to identify a single instance where a child became frustrated and gave up. They reported that all the children participated in group work and achieved personal satisfaction in doing so. The classroom environment for these students created attitudes where math anxiety would be less likely to develop.

Math Anxiety Among Different Groups

Although females are at risk for math anxiety, an examination of other groups suggest that the problem is widespread. Betz (1978) reported that elementary education majors were more anxious than majors in most other fields; teacher anxiety has been correlated with student anxiety. In a study of elementary teachers by Brown and Gray

(1992), experience, mathematics background, and positive attitudes towards math were significantly correlated with reduced math anxiety. Elementary teachers, however, are generally limited in their preservice mathematics education; thus less prepared to teach concepts involving abstraction, such as algebra.

In addition to differences in gender roles for mathematics, various ethnic groups also report higher levels of math anxiety. Hispanics and Native Americans in particular have higher anxiety levels in math situations (Hembree, 1990; Hadfield, Martin, & Wooden, 1992).

Likewise, lower socioeconomic groups show greater math test anxiety. Sapp, Farrell, & Durand (1985) reported in their study of economically and educationally disadvantaged college students, that mathematics tests produced more worry and emotionality test anxiety than reading or writing tests. They also found that worry test anxiety was the strongest contributor to test anxiety among this group of students.

Need for this Research

According to Flessati and Jamieson (1991), males may underreport their feeling of math anxiety because of cultural expectations that weakness in math is acceptable only for females. Most pertaining studies only measure math anxiety by means of self-report, and so may inaccurately reflect male math anxiety. This study will attempt to compensate for such discrepancies by comparing self reported math anxiety to math avoidance. Two measures will be used, the first, a mathematics anxiety rating scale, and the second, a survey to measure math avoidance behaviors.

Hypotheses

It is hypothesized that males experience as much math anxiety as females but respond with avoidance. The following hypotheses are offered regarding community college students:

1) *Males are less likely to report their math anxiety than females;*
2) *Males are less likely to seek help with math;*
3) *Males are just as likely as females to avoid taking required math courses;*
4) *Males avoid programs of study requiring math as frequently as females;*
5) *Student perception of math difficulty is related to math anxiety.*

Description of Math Anxiety & Avoidance

Anxiety results in subjective reports of tension, apprehension, sense of impending danger, dread, and expectations of inability to cope (Bootzin, Acocella, & Alloy, 1993). Among the behavioral responses to anxiety are avoidance of the feared situation, impaired speech and motor functioning, and impaired performance on complex cognitive tasks. Specifically, Richardson & Suinn (1972) defined math anxiety as "characterized by feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations."

In 1972, Richardson & Suinn developed the Mathematics Anxiety Rating Scale MARS. The MARS rating scale contains 98 items that measure math anxiety arising from the manipulation of numbers and the use of mathematical concepts. Subsequent researchers have constructed similar rating scales with fewer questions and different categories of math anxiety (Fennema and Sherman, Mathematics Anxiety Scale = MAS, 1976; Plake and Parker, Revised Mathematics Anxiety Rating Scale = RMARS, 1982; Sandman, Anxiety Toward Mathematics Scale = ATMS, 1976). Alexander & Martray (1989) developed an abbreviated MARS which they found to be equally valid and reliable as the full length MARS. Their abbreviated MARS divides math anxiety into three categories: math test anxiety, numerical task anxiety, and math course anxiety. Math test anxiety by far accounted for the most variance of the three factors comprising mathematics anxiety. This study used the math test anxiety subtest of Alexander & Martray's abbreviated MARS (1989).

Related to math anxiety is avoidance; avoidance is a means of escaping an unpleasant event. While written about extensively in conjunction with math anxiety, avoidance has not been quantified by self-reporting instruments such as the MARS for math anxiety. Instead, researchers have attempted to measure math avoidance by observing students' choice of major, course taking, and withdrawal from math related majors.

Procedures

Participants

The participants, 36 males and 54 females, were taken as a convenience sample drawn from a northeastern Community Technical College during the first two weeks of the Spring 1998 semester.

The sample was chosen from sections of the course English 101. This course was chosen because it is the lowest credit humanities course required of all Associate Degree students. Therefore, English 101 should provide a good representation of the overall student body.

The average age of the males was 24.9 and 26.3 for females. Males ranged in age from 18 to 54 and female ages ranged from 18 to 53. 58% of the males and 66% of the females were part time students. In an effort to obtain equal representation of full and part time students, four sections, two daytime and two evening, were arbitrarily chosen from a short list of classes whose teachers were likely to participate in the study. Daytime classes contain mostly full time students, while evening classes are generally comprised of part time students.

In order to promote accuracy, respondents were assured that the results would be kept strictly confidential. It was hoped students would be motivated to read and respond to each question carefully by informing them that the results of the study would be used to improve the test administrator's math teaching.

Instruments

Self reported math test anxiety was measured using one of the three subtests from a 5-item scale called the abbreviated version of the Math Anxiety Rating Scale, MARS, (Alexander & Martray, 1989). The subtest measuring math test anxiety contains 15 questions and is shown in Table 11 of Appendix A. Alexander & Martray's three subtests were reported to have .96 internal consistency compared to .97 for the ninety-eight question full length MARS (Richardson & Suinn, 1972). Math test anxiety has been found to prompt the highest incidence of anxiety and so has been chosen over the other two subtests (Numerical Task Anxiety, Math Course Anxiety) for measuring math anxiety. Each of the 15 questions are scored 1 through 5 for causing anxiety: 1 - "not at all," 2 - "a little," 3 - "a fair amount," 4 - "much," 5 - "very much." An individual's score is calculated by summing the ratings of each question. From here forward, MARS will be used to indicate math test anxiety derived from the abbreviated version of the Math Anxiety Rating Scale as developed by Alexander & Martray (1989).

The second instrument was specifically designed for this study by the author. The 15-question survey, shown in Table 12 of Appendix A, was designed to measure math avoidance by collecting data on possible math avoidance behaviors. The questionnaire was given to a small sample of students in various stages of development to eliminate areas of confusion and attain a test time of under fifteen minutes. Preliminary sample students reported that the final survey was clear. A retest of actual participants, however, was not performed to assess reliability.

Limiting Factors Affecting Study

The sample at this community college was a convenience sample, not randomly selected. Therefore, statistical inferences refer to a population not necessarily representative of a typical community college. To the extent that the demographics of each community college vary, the results may also vary between colleges. Furthermore, results were obtained from adults in post secondary education. Therefore, attempts to apply the results to earlier grades will produce uncertain results

As was discussed in the review of literature, math anxiety and math avoidance have many causes. Attitudes toward math have been found to be highly correlated with math anxiety (Fennema & Sherman, 1976). Only the last hypothesis (perception of math difficulty is related to math anxiety), dealt with attitudes and their bearing on math anxiety. It is left to other studies to investigate the relationship of attitudes on math anxiety and math avoidance.

Analysis of Data

Hypothesis 1

I first compared male and female math anxiety to see if females do indeed report higher levels of math anxiety. Hypothesis one states: *Males are less likely than females to report their math anxiety.* The mean male and mean female math anxiety were measured by the MARS, shown in Table 11 of Appendix A. MARS scores can range from a low of 15 = "no anxiety", to a high of 75 = "very much anxiety." The independent variable was Gender and the dependent variable was MARS math test anxiety.

Although the standard deviation for the population was not known, the sample was large enough $n > 30$ to use the standard normal distribution (z) for performing a one-tailed test at the (alpha) $\alpha = .05$ level of significance; $-z(.05) = -1.645$. The null and alternative hypotheses were:

Ho: Male anxiety = Female anxiety, ($\mu_1 = \mu_2$).

Ha: Male anxiety < Female Anxiety, ($\mu_1 < \mu_2$).

A standard z score was calculated using the formula: $z = (\bar{x}_1 - \bar{x}_2) / \sqrt{(s_1^2/n_1 + s_2^2/n_2)}$ to test for a significant difference between $\bar{x}_1$ male MARS and $\bar{x}_2$ female MARS. Table 1 shows the means, standard deviations, and sample sizes.

Table 1

Male and Female Mathematics Test Anxiety (MARS)

	M	SD	n
Male	40.8	13.4	36
Female	46.2	14.1	54

The results from Table 1 give $z = -1.834 < -1.645$ so the null hypothesis Ho was rejected; the actual probability of a type 1 error, found by interpolating linearly between table values, was p = .033. Therefore, there was sufficient evidence at the .05 level of significance to show that males were less likely than females to report their math anxiety as measured by the MARS.

Males averaged almost 5 and 1/2 points lower than the females. This translates to an average 1/3 point lower on each of the fifteen questions for the abbreviated MARS. Presented in Figure 1 is a grouped relative frequency chart for male and female MARS scores. Six groups of math anxiety were formed, scores ranged from 18 to 75.

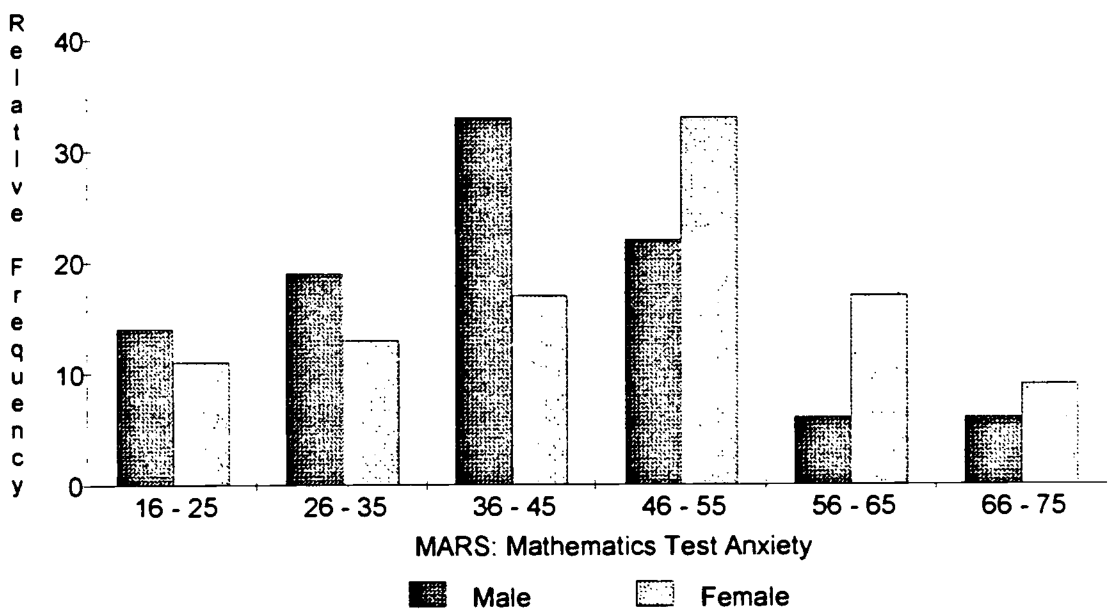

Figure 1. Relative frequency (percent) of mathematics test anxiety (MARS).

Relative frequencies in Figure 1 were calculated by dividing the male and female frequencies by the total in each of their samples. These were then multiplied by 100 to obtain a percentage of each sample. Both distributions were approximately normally distributed. Comparing modal groups, male 36 - 45 female 46 - 55, reveal the higher tendency of female MARS scores. Also, the skewness, male positively female negatively, indicate a clustering of female MARS scores above the center, and a clustering of male MARS scores below the center of their respective distributions.

For further comparison, Figure 2 shows a Box-and-Whisker Plot of male and female MARS scores. The higher shift of female scores referred to above is evident by the boxes. The alignment of the male 75th percentile with the female median, indicates that almost 75% of the male MARS scores occur below the middle MARS score for females.

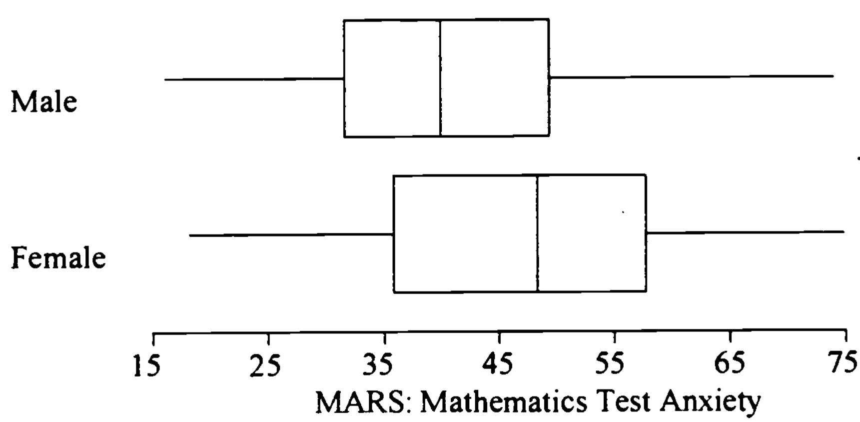

Figure 2. Male and female mathematics test anxiety (MARS).

Hypothesis 2

Given that females tended to have higher mathematics anxiety I investigated the hypothesis that: *Males are less likely to seek help with math.* The degree of help sought was measured by questions 14 and 15 of the Math Avoidance Survey, shown in Table 12 of Appendix A. Both questions contained four categories of math help: Math Lab, Teacher, Tutor, and Classmates. Question 14 asked for help sought in the past, while question 15 asked if students would be willing to get help in the future. A help score, ranging from 0 - 8, was then obtained by adding the responses from both questions. Math help sought in the past, question 14, was deemed not relevant for students in the study who had not yet taken a math course, they were included but their maximum help score was 4. Means were obtained for male and female math help to test the null and alternative hypotheses:

Ho: Math help sought for males = Math help sought for females ($\mu_1 = \mu_2$).

Ha: Math help sought for males < Math help sought for females ($\mu_1 < \mu_2$).

The independent variable was gender and the dependent variable was math help sought. A one-tailed z test was performed with a level of significance, $\alpha = .05$; $-z(.05) = -1.645$. As with hypothesis one, a standard normal z score was calculated using the formula $z = (\bar{x}_1 - \bar{x}_2) / \sqrt{(s_1^2/n_1 + s_2^2/n_2)}$ to see if there was a significant difference between $\bar{x}_1$ = mean male math help and $\bar{x}_2$ = mean female math help. The means, standard deviations, and sample sizes are shown in Table 2

Table 2

Male and Female Math Help Sought

	M	SD	n
Male	2.6	1.7	36
Female	3.4	1.9	54

The calculated value of z was -2.114 < -1.645 so the null hypothesis Ho was rejected. Linear interpolation between table values yielded p = .017. Therefore, there was sufficient evidence at the .05 level of significance to show that males seek less help with math than females. Next, avoidance of required math courses is considered.

Hypothesis 3

Three tests were performed to test the hypothesis that *Males and females are equally likely to avoid taking required math courses.* In Test 1, I compared the male and female average number of college courses before taking their first college math course. In Test 2, I compared the proportion of males and females who had not taken the computerized college placement test. And in Test 3, I compared the highest math course that males and females took in high school.

Test 1. As stated above, a comparison was performed between the male and female average number of college courses taken before a first college math course. Students provided data for testing this hypothesis from question 9 of the Math Avoidance Survey, shown in Table 12 of Appendix A. Students could answer in one of two ways. They could provide the number of courses they took before their first math course, or if they had not taken a math course, they could provide the intended number of courses before taking their first math course. In either case, responses were considered equivalent for purposes of calculating the mean. Some students answered that they would take as many courses as possible before their first math course; they were given a numerical score of 15. Scores for this test could range from 0 to 15. Some students did not answer this question. They were omitted from the sample. The null and alternative hypotheses were:

Ho: Male math avoidance = Female math avoidance. ($\mu_1 = \mu_2$).

Ha: Male math avoidance ≠ Female math avoidance ($\mu_1 \neq \mu_2$).

The independent variable was gender and the dependent variable was math course avoidance. A two-tailed z test was performed with a level of significance, $\alpha = .05$; $z(.025) = 1.96$. A standard score z was calculated using $z = (\bar{x}_1 - \bar{x}_2) / \sqrt{(s_1^2/n_1 + s_2^2/n_2)}$ to see if there was a significant difference between $\bar{x}_1$ = mean male courses before first math and $\bar{x}_2$ = mean female courses before first math. The means, standard deviations, and sample sizes are shown in Table 3.

Table 3

Number of Courses Before First Math Course

	M	SD	n
Male	2.1	3.9	28
Female	2.7	3.7	43

The standard score z was -.568 which fell in the noncritical region. Consequently, I failed to reject the null hypothesis. This is consistent with the research hypothesis that males and females are equally likely to avoid taking required math courses.

Test 2. As an alternative to test 1, math avoidance was measured by using the percentage of males and females who had not taken the computerized placement test. The placement test is required of all students. It measures a student's academic skills to see if there is a need for remediation. Depending on the results of the placement test, students may be required to take additional noncredit courses for preparation into entry level math and English courses. It was hypothesized that students might avoid the placement test due to math competency requirements.

I compared the proportion of male students to female students who had not taken the computerized placement test, question 13 of the Math Avoidance Survey. Although the number of non-placement testers was low, n = 3 males, n = 5 females, I calculated a standard score using the difference between proportions of the male and female samples. Null and alternative hypotheses were:

Ho: Male proportion no placement test = Female proportion no placement test. ($p'_1 = p'_2$).

Ha: Male proportion no placement test ≠ Female proportion no placement test. ($p'_1 \neq p'_2$).

The independent variable was gender, and the dependent variable was the proportion of students who had not taken the placement test. A two-tailed z test was performed with a level of significance of $\alpha = .05$; $z(.025) = 1.96$. The standard score z was calculated using $z = (p'_1 - p'_2) / \sqrt{(p'_p q'_p(1/n_1 + 1/n_2))}$ to find the standard score associated with the difference between the two proportions. Totals were found, where x_1 = total males with no placement test, and x_2 = total females with no placement test. Proportions were found by: $p'_1 = x_1/n_1$ proportion of males, and $p'_2 = x_2/n_2$

proportion of females. The pooled observed probability was $p'_p = (x_1+x_2) / (n_1 + n_2)$, with $q'_p = 1 - p'_p$. The proportions, pooled observed probability, and the sample sizes are shown in Table 4.

Table 4

Students Who Had Not Taken the Placement Test

	Observed Proportion, p'	Pooled Observed Probability, p'_p	n
Male	.086	.091	35
Female	.094	.091	53

The calculated standard score z was -.128, which fell in the noncritical region. Therefore, I failed to reject the null hypothesis. It is concluded that males and females are equally likely to avoid the placement test. This was consistent with the research hypothesis that males and females are equally likely to avoid taking required math courses.

Test 3. For the last test of hypothesis 3, I measured math avoidance by how many math courses a student took in high school. Participants in this study were asked, in question 11 of the Math Avoidance Survey, to list their high school math courses. It was hypothesized that the amount of math taken in high school was not significantly related to gender. Independence of gender was tested against highest math course taken in high school using chi-square analysis. Students were placed into one of six cells of a

2 (Gender) X 3 (Highest math taken in high school) chi-square contingency table. High school math courses were divided into three groups, columns 1 - 3 of the contingency table: Column 1 = Low Math: Basic math through Algebra 1; Column 2 = Medium Math: Geometry through Algebra 2 and; Column 3 = High Math: Trigonometry through Calculus. Independence of gender versus high school math was then tested using the null and alternative hypotheses:

Ho: Highest level of math is independent of gender.

Ha: Highest level of math is not independent of gender.

A chi-square test was performed at the α = .05 level of significance; the critical value of the chi-square with degrees of freedom, df = 2 was $\chi^2(2,.05) = 5.99$. The deviation of the observed values, O, from the expected values, E, was calculated using $\chi^2 = \Sigma(O\text{-}E)^2/E$. The observed and (expected) values of each cell of the chi-square contingency table for level of highest math taken in high school are shown in Table 5.

Table 5

Level of Highest Math Taken in High School, Observed and (Expected) Values

	Low Math	*Medium Math*	*High Math*	Total
Male	9 (11.32)	18 (18.20)	9 (6.47)	36
Female	19 (16.68)	27 (26.80)	7 (9.53)	53
Total	28	45	16	89

Consequently, I failed to reject the null hypothesis; $\chi^2 = 2.463 < 5.99$. Consistent with the research hypothesis, choice of math in high school is independent of gender. It is concluded that females are no more likely than males to avoid math in high school. Next, I looked at avoidance of majors based on the amount of math required.

Hypothesis 4

Two tests were conducted to investigate the hypothesis that: *Males and females are equally likely to avoid programs of study requiring math.* In test 1, I looked to see if there was a relationship between gender and the number of math courses required of a major. In test 2, I looked to see if there was a relationship between gender and selection of a major because it required little math.

Test 1. Is a students choice of major related to avoidance of math? This question was investigated by examining the amount of math required of students' majors. Students were asked to give their college program of study (questions 4 & 5, Math Avoidance Survey). Majors were then identified in the 1997 - 1999 student catalog to determine the amount of math required of each selected major. Independence of gender against math required of major was then tested using chi-square analysis. Students were placed into one of six cells of a 2 (Gender) X 3 (Math Required of Major) chi-square contingency table. Math required of major was divided into three groups, columns 1 - 3 of the contingency table: Column 1 = Little Math: One or less math course; Column 2 = Medium Math: two math courses and; Column 3 = Lots Math: three or more math courses. The null and alternative hypotheses for testing independence were:

Ho: Math required of major is independent of gender.

Ha: Math required of major is not independent of gender.

A chi-square test was used with a level of significance, $\alpha = .05$; the critical value of the chi-square with df = 2 was $\chi^2(2,.05) = 5.99$. The sum of the deviations for each cell were found by using $\chi^2 = \Sigma(O-E)^2/E$. The 2 X 3 chi-square contingency table for math required of major is shown in Table 6.

Table 6

Math Required of Major, Observed and (Expected) Values

	Little Math	*Medium Math*	*Lots Math*	Total
Male	10 (18.13)	8 (5.24)	9 (3.63)	27
Female	35 (26.87)	5 (7.76)	0 (5.37)	40
Total	45	13	9	67

The null hypothesis was rejected, $\chi^2 = 21.856 > 5.99$; $p < .001$. Therefore, preference for majors based on required math is not independent of gender. There is sufficient evidence at the .05 level of significance to show that females avoid programs of study based on the math requirement more frequently than males. The strength of association between gender and math required of major was .50. It was found using the contingency coefficient, $C = \sqrt{(\chi^2/(\chi^2 + N))}$ for chi-square contingency tables. Similar to a linear correlation coefficient, C can take values up to 1 for complete association. Thus C = .50 reveals a moderate relationship between gender and math required of a major. Nevertheless, students were given the opportunity to explain the reasons for choosing their major in question 6 of the Math Avoidance Survey, and no females chose their major due to a low math requirement.

Test 2. When students give their reasons for choosing a major, do they choose that major because it requires little math. This was the intent of question 6 of the Math Avoidance Survey. It was hypothesized that males would be as likely as females to pick their major due to a small math requirement. However, no females and only one male chose their major for that reason. Due to such a small response no further data analysis was performed on this hypothesis.

Hypothesis 5

Lastly, I tested the hypothesis that *Student perception of math difficulty is associated with math anxiety.* Two tests were performed toward that end. Test 1 looked for the relationship between perceived math difficulty and math anxiety using chi-square. And test 2, compared the mean math anxiety of those finding math most difficult to the mean math anxiety of those finding other subjects most difficult.

Test 1. Question 12 of the Math Avoidance Survey states: Which type of course is most difficult: English, History, Science, or Math. The responses were categorized into two groups: those finding math most difficult (M) and those not finding math most difficult (E,H,S). These two groups were further categorized by low math anxiety, MARS 16 - 45, and high math anxiety, MARS 46 - 75. A separate 2 (MARS) X 2 (Math Intensity) chi-square contingency table was used for males and females to test the relationship of perceived math difficulty (Math Intensity) to math anxiety (MARS). The null and alternative hypotheses were:

Ho: View of math difficulty is independent of math anxiety.

Ha: View of math difficulty is not independent of math anxiety.

A chi-square test was performed using a level of significance, $\alpha = .05$. A critical value was obtained for df = 1: $\chi^2(1,.05) = 3.84$ and compared with the calculated chi-square $\chi^2 = \Sigma(O-E)^2/E$. Table 7 shows the 2 X 2 contingency table for males.

Table 7

Male Math Intensity, Observed and (Expected) Values

	Yes (M)	*No (E,H,S)*	Total
Low MARS	7 (9.33)	17 (14.67)	24
High MARS	7 (4.67)	5 (7.33)	12
Total	14	22	36

I failed to reject the null hypothesis, $\chi^2 = 2.86 < 3.84$; $p < .10$. For males, then, math intensity is independent of math anxiety. There is not sufficient evidence at the .05 level of significance to show that male perception of math difficulty is related to math anxiety.

I performed a similar test for females. Table 8 shows the female 2 X 2 contingency table. I failed to reject the null hypothesis: $\chi^2 = 1.52 < 3.84$. Therefore, female view of math difficulty is independent of math anxiety. There is not sufficient evidence at the .05

level of significance to show that female perception of math difficulty is related to math anxiety.

Table 8

Female Math Intensity, Observed and (Expected) Values

	Yes (M)	*No (E,H,S)*	Total
Low MARS	6 (8.15)	16(13.85)	22
High MARS	14 (11.85)	18 (20.15)	32
Total	20	34	54

Test 2. As an alternative to test 1, the mean math anxiety of the group finding math most difficult was compared to the group finding English, history, or science most difficult. Separate analyses were performed for males and females. The null and alternative hypotheses were:

Ho: Math anxiety (M) = Math anxiety (E,H,S), ($\mu_1 = \mu_2$).

Ha: Math anxiety (M) > Math anxiety (E,H,S), ($\mu_1 > \mu_2$)

The independent variable was math intensity and the dependent variable was math anxiety. A one-tailed z test was performed with an $\alpha = .05$ level of significance; $z(.05) = 1.645$. I calculated the standard score $z = (\bar{X}_1 - \bar{X}_2) / \sqrt{(s_1^2/n_1 + s_2^2/n_2)}$ to see if there was a significant difference between $\bar{X}_1$ = mean MARS for math most difficult, and $\bar{X}_2$ = mean MARS for other courses most difficult. The means, standard deviations, and sample sizes for males are shown in Table 9.

Table 9

Male MARS for Low and High Math Intensity

	M	SD	n
Yes (M)	45.4	14.8	14
No (E,H,S)	37.9	11.9	22

The calculated value of z was 1.598 < 1.645, so I failed to reject Ho; p = .055. There is not sufficient evidence at the .05 level of significance to show that math anxiety for males finding math most difficult is significantly different than math anxiety for males finding other subjects most difficult. Shown in Table 10 are the means, standard deviations, and sample sizes for females.

Table 10

Female MARS for Low and High Math Intensity

	M	SD	n
Yes (M)	49.9	14.2	20
No (E,H,S)	44.1	13.8	34

Again, a one tailed z test yielded: z = 1.466 < 1.645, so I failed to reject the null hypothesis; p = .071. There is not sufficient evidence at the .05 level of significance to show that math anxiety for females finding math most difficult is significantly different than math anxiety for females finding other subjects most difficult.

With p values of .06 for males and .075 for females, the results would have been significant, if a level of significance of α = .10 were chosen. With this less conservative value of α it was determined that a relationship might have existed between perceived math difficulty and math anxiety, even though I failed to reject the null hypothesis.

Interpretation

Summary of the Findings

The purpose of this study was to examine math anxiety and the ways in which males and females react to that anxiety. Does math anxiety relate to math avoidance, and if so, is it different across gender? It is proposed that self reported math anxiety may not fully measure an individual's actual fear of math, because those that do not choose to express their anxiety will avoid math. Thus, a more complete picture was attempted by recording math avoidance behaviors.

The summarization of the findings of the hypotheses discussed in the Analysis of Data are that males reported less math anxiety than females, sought less help with math, and were as likely as females to avoid taking required math courses. Contrary to the supposition in hypotheses four, females did avoid programs of study requiring math more frequently than males. Lastly, with a level of significance of $\alpha = .05$, student perception of math difficulty was not associated with math anxiety. The two variables were, however, found to be associated at a level of significance of $\alpha = .10$.

Research Hypotheses Examined in Light of the Findings

Math Anxiety. It is not surprising that males reported less math anxiety than females. This is consistent with findings from other studies (Alexander & Martray, 1989; Dew, Galassi, & Galassi, 1984; Fennema & Sherman, 1977).

Alexander & Martray (1989) developed the abbreviated MARS used in this study. Although they did not break down their results by gender, they found that the means for math test anxiety for college students ranged from "a little," (2) to "a fair amount," (3). Results of this study produced an average MARS of just below 3.

Community college students may be more motivated to attain mathematical skills after high school because of general education requirements related to career goals. Nevertheless, given the negative responses of students, particularly females, to traditional mathematics instruction, it is not surprising that females exhibited more math anxiety than their male counterparts in this study. Gender differences regarding math assistance are discussed next.

Help With Math. Results from hypothesis two suggest that females were significantly more willing than males to seek help with math. The results have several possible meanings, depending on gender perspective. I examine females first and then males. If females account for their success by effort, as suggested in the review of literature, then they would be expected to use more resources than males in achieving the same success. This scenario implies that females perceive themselves as needing more math help than males.

Alternatively, the same result from hypothesis three restated in terms of males willingness to seek help is: males are less willing than females to seek help in math. This leads to three possible conclusions. Males seek less help with math because they do not need it, or they perceive themselves as not needing help, or they are afraid or reluctant to admit the need for help with math. The first supposition appears unlikely. Llabre and Suarez (1985), in a study of college students, found that women received significantly higher math grades than men. Thus, it would appear males need as much help with math as females.

Secondly, in this study it seems unlikely that males perceive themselves as not needing math help. The percentage of males and females who recorded math as their most difficult subject were not significantly different. For males, then, it appears they are afraid or reluctant to admit the need for math help.

The female and male perspectives restated are that females seek more math help than males because they think they need it, and males seek less math help because of fear or reluctance. Further research is needed to determine the extent of the male and female contribution to the hypothesis 3 conclusion that males seek significantly less math help than females.

Math Avoidance. If the abbreviated MARS correlated well with math avoidance, then males should have avoided math less frequently than females because their MARS scores were lower. This was not the case; there was not a significant gender difference between courses before these students' first math course. Neither was there a significant gender difference for avoiding the placement test. 9% of the males n = 3, and 9% of the females n = 5, did not take the college placement test. Students might avoid the placement test for a variety of reasons. It was theorized that the threat of being placed in a noncredit math course would cause students to avoid the test. Students might also avoid the test due to the English requirement or because they forgot to take the test and were not reminded by their advisor. Further research is needed to quantify these effects.

I also checked math avoidance by looking for a gender difference in math courses taken in high school; I did not find a significant difference. It was theorized that taking fewer math courses than the average student was due to math avoidance. Follow-up questions regarding high school math course enrollment are recommended to eliminate other possible reasons for not taking as much math.

Relationship Between Math Anxiety and Math Avoidance. Three tests support the contention that males and females are equally likely to avoid required math courses. What is the relationship between math avoidance and math anxiety? I performed correlation analysis and found the correlation coefficients between the MARS scores and the number of courses before taking a math course to be $r = .50$ for males and $r = .30$ for females. These are moderate to low correlations, with males having the stronger association between variables. This implies that the MARS may predict male math avoidance better than it does for females. Hembree (1990) investigated the relationship between math anxiety and math avoidance. He found that among high school students, males with higher levels of math anxiety were less likely than high-anxious females to take more mathematics.

Descriptive methods were also used for investigating the relationship between math anxiety and math avoidance. Figure 3 shows the male scatter plot of MARS scores versus the number of courses before first math course.

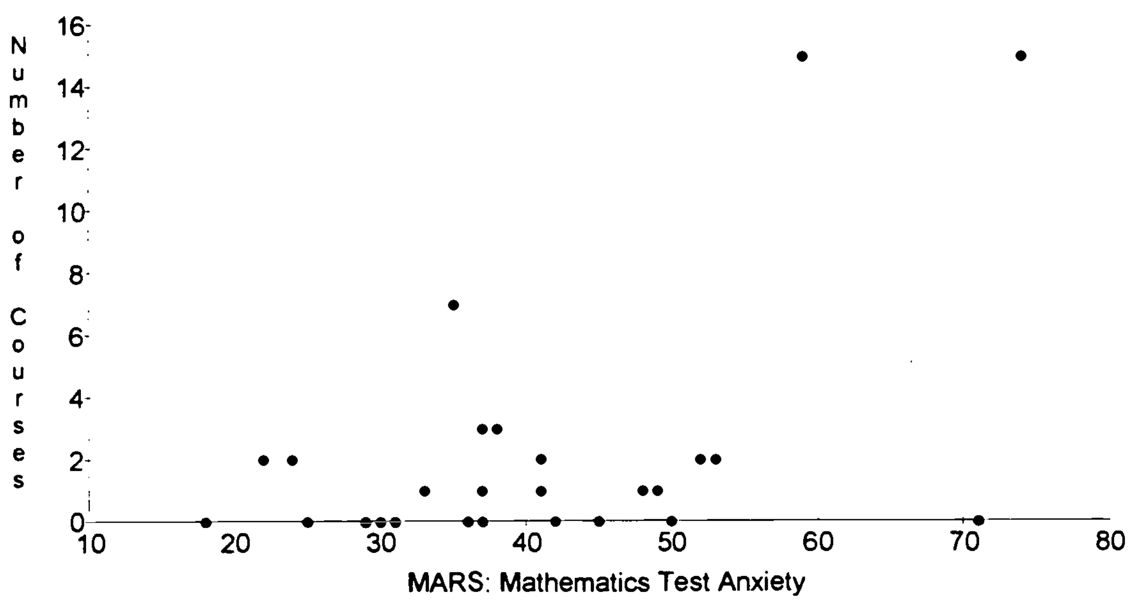

Figure 3. Male mathematics test anxiety (MARS) versus number of courses before first math course (math avoidance).

The male scatter plot reveals two pictures. First, the majority, 89% of males, have MARS scores less than 59. Consider data points as the ordered pairs (MARS, Math Avoidance), all but three ordered pairs, (35, 7), (59, 15), and (74, 15); are clumped along the MARS axis, with none of these students waiting more than three courses before taking their first math course. For the majority of males, math avoidance is low and does not increase with higher MARS scores.

A second picture is revealed by those male data points comprised of MARS scores greater than or equal to 59. There are three, (59, 15), (71, 0), and (74, 15). Two of these three males waited 15 courses before taking their first math. Thus, high male MARS scores seem to correlate with high levels of math avoidance. The two views taken together, indicate that generally a male is not likely to report high amounts of math anxiety, but if he does, he is likely to avoid taking mathematics courses. Given the few males with high levels of math anxiety, it is recommended that larger samples of highly math anxious males be collected to test this conclusion.

Let us turn to female MARS scores versus the number of courses before first math course. The scatter plot is shown in Figure 4. Two groups of data are prominent in the female scatter plot. The first group is comprised of female students with fewer than six courses before their first math course, and the second group is comprised of females with six or more courses before their first math course. 84% of the female respondents are in this first group of low to moderate math avoiders. There is a slight, but not substantial, tendency for levels of math avoidance to increase as MARS scores increase. Note that this group of female avoiders contains MARS scores all the way up to the maximum

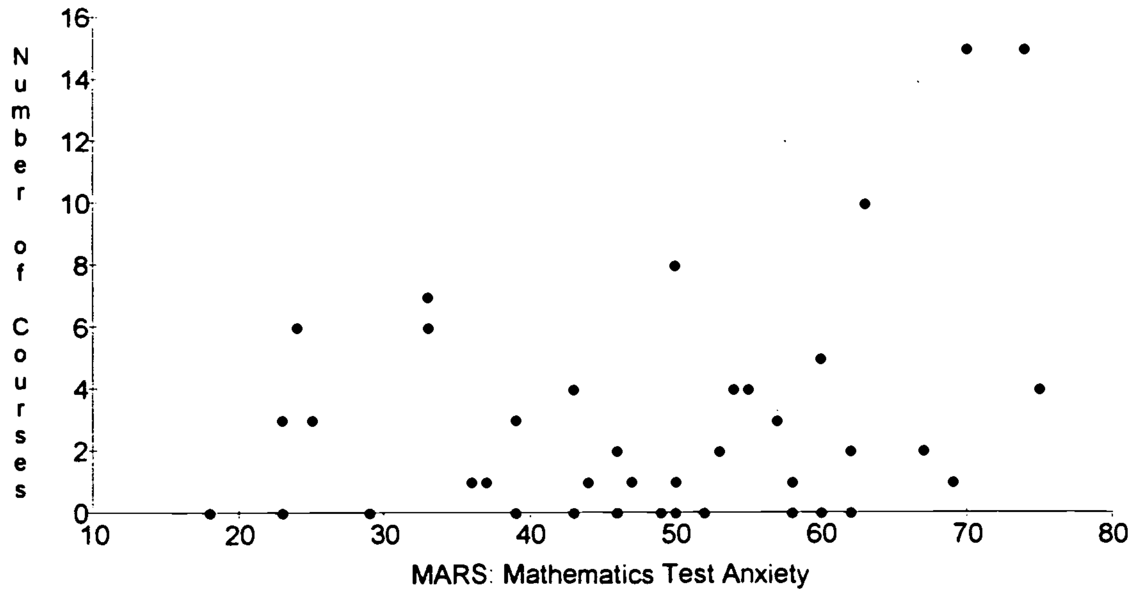

Figure 4. Female mathematics test anxiety (MARS) versus number of courses before first math course (math avoidance).

MARS score of 75. Whereas, the low male avoider group, has all of its MARS scores, but one, below 54. It is inferred from this first group of data that females have low to moderate math avoidance across the full spectrum of MARS scores. Males on the other hand, only have low math avoidance at the mid to low MARS score levels.

The second group of female data, comprised of females waiting six or more courses before taking their first math course, shows a stronger relationship between math anxiety and math avoidance. The seven scores of this group form a curvilinear figure with positive increasing slope. Among these highest math avoiders, there is an exponential increase in math avoidance as MARS scores increase. Therefore, if a female is highly math avoiding, increases in math anxiety will intensify her math avoidance. It is worth noting, however, that these high math avoiders begin at a MARS score of 24. This is quite low, and supports the theory that female math avoidance can occur at any level of math anxiety. I infer from this, that the MARS instrument alone is less capable of predicting female math avoidance than it is for males.

I chose six courses before taking a math course as a logical point where students become at risk for adverse effects from math avoidance. Six courses, for the average student, translates to anywhere between one to three semesters of course work. Certainly, this places stress on a student's ability to complete their major's math requirement in a timely fashion for advancing career goals.

Although more research is needed among high math avoiders, it is contended that high MARS scores present a greater risk for male math avoidance than it does for females. In a meta-analysis of math anxiety, Hembree (1990) found that among college students math anxiety only correlated $r = .32$ with a student's intent to take more math. Even though there was a stronger association between these variables for males, the MARS instrument does not appear to be a very strong predictor of math avoidance for either sex.

Course Taking. Since a portion of females avoid math at all levels of math anxiety, I looked to other causes for female math avoidance. As discussed in the review of literature, the gap between male and female high school math is closing except at the highest levels of course taking. Although students in this study rarely took a course over trigonometry, 8% males and 6% females, I found that high school math was independent of gender (test 3, hypothesis 3). Still, preparation for college math is in need of improvement for both sexes.

Only 53%, slightly over half, of the male and female respondents reported taking Algebra 2 or a higher math course in high school. Interestingly, one student reported taking Calculus and that was a female. Although 28% of males were enrolled in college majors requiring substantial math, (engineering and computers), none took Calculus in high school, 8% took Precalculus, and 19% took Trigonometry. No females reported majors requiring heavy math, but 13% listed having taken Trigonometry or above in high school. In this study, community college students lacked the rigor of high school math expected for majors in engineering and computers.

Further proof of inadequate preparation for college math courses is evidenced by the course level at which these students began their college math. 74% of the male sample and 90% of the female sample began their math at or below Elementary Algebra at this community college. Only 13% of the males and 5% of the females placed into credit-bearing math courses. Thus, any improvements that have been made in core curriculum requirements for high school math, have had little influence in advancing college students past the most basic of college mathematics courses.

Influence of Math on Major. Although major was not found to be independent of gender as I had hypothesized, no females reported choosing their major because it required little math. Furthermore, regression analysis showed little correlation between chosen major and math anxiety or math avoidance for females. As suggested earlier, factors other than math requirements are probably influencing a female's choice of major. Choice of major for females may be less about math anxiety or math avoidance then it is about finding areas of study more satisfying and with more positive peer feedback.

One male chose his major due to little math and two males picked their major because it required a lot of math. Perhaps males associate more strongly toward math then do females, whether it be positive or negative. More male responses are needed to test this theory.

Math Anxiety and Perceived Course Difficulty. If math is perceived as difficult, does it relate to math anxiety? Results from hypothesis 5 suggest there may be an association. The chi-square analysis revealed these two variables to be independent. Using the predetermined level of significance of α = .05, I found no significant difference between the mean math anxiety of students finding math most difficult to the students finding English, history, or science most difficult. By choosing a more conservative level of significance, α = .10, however, I did find a significant difference in means.

I conclude the interpretation of results by comparing male and female perception of their most difficult course; see Figure 5.

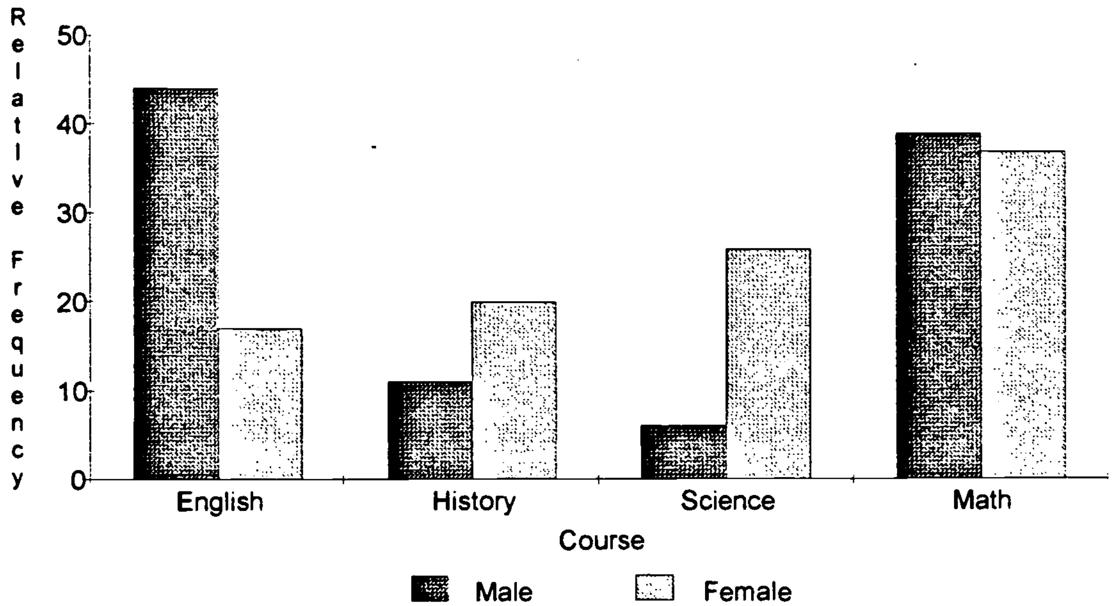

Figure 5. Relative frequency (percent) of perceived most difficult course.

Both sexes responded similarly regarding math difficulty, male (39%) females (37%). Given that females were more math anxious than males, it was expected that they would report math as their most difficult subject with greater frequency than males. Since females did not report math as most difficult with greater frequency, it is concluded that factors in addition to math anxiety are influencing their math avoidance.

Ranked in increasing order of relative frequency, females found English (17%), history (20%), science (26%), and math (37%) to be their most difficult subject. Several speculations can be offered for this order of course difficulty. One might conclude that the more math a course involves, the more likely a female is to find that course difficult. Equally likely, females might construe the learning environment in these courses to be progressively more hostile to their method of interaction.

Males, on the other hand, ranked science (6%), history (11%), math (39%), and English (44%) as most difficult. English and math accounted for 83% of the responses. Interestingly, males found math to be most difficult 39%, almost as frequently as they did English 44%.

Conclusions

Summary

I conclude that females did indeed report significantly higher levels of mathematics anxiety than did males. For females, though, high levels of math anxiety did not necessarily translate to a high degree of math avoidance. Males did choose math related majors significantly more than females, but I did not find a significant difference between male and female highest math course taken in high school. Nor did I find a significant difference between male and female college courses taken before a math course. Rather than avoid math due to math anxiety, it appears females are more willing to seek help. I found that females sought significantly more help with math than did males. Lastly, I found that among the courses of English, history, science, and math; math anxiety did not relate to a perception of math as the most difficult subject, for either males or females, unless the test criteria was lowered to a level of significance of $\alpha = .10$.

I expected female enrollment in math majors to have increased due to changing mores regarding the participation of females in math related careers. This was not the case, and I assert that female community college students avoid majors involving a substantial amount of math, because of reasons in addition to or in lieu of mathematics anxiety.

Implications for Professional Practice

Given the results from this study, I submit that Alexander & Martray's (1989) subtest measuring mathematics test anxiety represents a moderately useful measure for school professionals for predicting male math avoidance and to a lesser degree female math avoidance. Highly math anxious males and females with a history of math avoidance may be at risk for college math avoidance due to math anxiety. It is recommended that college math departments inform their teachers as to the needs of this special group, and provide assistance in the form of math labs and individual tutoring. Furthermore, college counseling departments should assist these students in behavioral techniques, such as systematic desensitization and anxiety management, to lessen the amount of anxiety arising from math instruction (Hembree, 1990). It is also recommended that these math anxious students be given literature to read, such as Self-help Kit for Students: Math Anxiety, Math Avoidance, Reentry Mathematics (Tobias, Melmed, & Lazarus, 1980).

The review of literature suggests that inroads might be made on math avoidance, if traditional instruction is augmented with more interactive and experiential instruction by teachers willing to form more nurturing relationships with their students. In the absence of such changes, young females might benefit from techniques which build more independent modes of learning, choice making, and assessment of their abilities so they might better survive the often competitive mathematics environment (Seymour, 1995).

Recommendations for Future Research

In this study, there were few male participants with both high levels of math anxiety and high levels of math avoidance. Nonetheless, results seem to indicate that math anxious males might be highly math avoiding. It is recommended that math avoidance be measured on a larger group of highly math anxious males in order to test this theory.

The review of literature suggests females may avoid math because of societal norms that dictate females as less appropriate and less able to perform in math situations. . Thus, female math avoidance may not be adequately treated by reducing math anxiety. Further research with high math avoiding females is needed to more fully explore the dual relationship between math anxiety and math avoidance. It is also recommended that a sample of female college math avoiders be given open interviews to explore the reasons for their math avoidance, and begin the process of quantifying these reasons, so that a more appropriate instrument may be developed to measure female math avoidance.

Finally, I was surprised that no females reported a major that required a substantial number of math courses. It was theorized that math anxiety, ability, achievement, and past course work are not significantly responsible for female mathematics avoidance. Are male prescribed societal norms still causing females to avoid analytical programs of study? If so, researchers might change their focus from female interventions, to interventions which focus on changing attitudes toward females performing math.

Appendix A

Table 11
An Abbreviated Version of the MARS for Math Test Anxiety
(Alexander & Martray, 1989)

1. Studying for a math test
2. Taking math section of college entrance exam
3. Taking an exam (quiz) in a math course
4. Taking an exam (final) in a math course
5. Picking up math textbook to begin working on a homework assignment
6. Being given homework assignments of many difficult problems that are due the next class meeting
7. Thinking about an upcoming math test 1 week before
8. Thinking about an upcoming math test 1 day before
9. Thinking about an upcoming math test 1 hour before
10. Realizing you have to take a certain number of math classes to fulfill requirements
11. Picking up math textbook to begin a difficult reading assignment
12. Receiving your final math grade in the mail
13. Opening a math or stat book and seeing a page full of problems
14. Getting ready to study for a math test
15. Being given a "pop" quiz in a math class

Appendix A

Table 12
Math Avoidance Survey

1. Gender: Male____, Female____ 2. Age____ 3. Full time____, Part time____

4. Are you studying for an Associate Degree (20 or 21 courses)? Yes___, No___, Not sure___
   If yes, what is your planned program of study?______________________, Not sure___

5. Are you studying for a Certificate Program? Yes___, No___, Not sure___
   If yes, what is your Certificate program?_________________________, Not sure___

6. What influenced your choice of study?
   Advice from others____ Requires little math____ Requires lots of math____ Interest____
   Financial Reward____ Employer required____ Advance current career____
   Other____

7. How many courses will you have taken when you complete community college?____

8. Including all schools, how many college courses have you taken so far?____

9. Have you taken a math course at college? Fill in box that applies.

Yes	No
How many college courses did you take <u>before</u> your first math course?____	How many college courses will you take <u>before</u> your first math course?____

10. What college math courses, if any, have you taken? Check all that apply.
    Math 91 or 92 College Arithmetic____
    Math 95 or 96 Elementary Algebra____
    Math 102 Intermediate Algebra____
    Math 105 Geometry____
    Math 106 Number Systems____
    Math 108 Elementary Statistics____
    Math 109 Applied Mathematics____
    Math 113 College Algebra____
    Math 114 Technical College Algebra____
    Math 117 Technical Precalculus____
    Math 120 Applied Calculus____
    Math 200 Trigonometry & Analytical Geom.____
    Math 205 Calculus I____
    Math 206 Calculus II____
    Math 207 Calculus III____
    Math 218 Technical Calculus I____
    Math 219 Technical Calculus II____
    Others____________________________

11. What math courses did you take in high school?
    Basic Math____ Business Math____ General Math____ Consumer Math____ Algebra 1____
    Geometry____ Algebra 2____ Trigonometry____ Pre-Calculus____ Calculus____
    List other math courses ______________________________________

12. Which type of course is most difficult? English___, History___, Science___, Math___

13. Have you taken the computerized placement test? Yes___, No___, Not Sure___

For questions 14 and 15 check all that apply

14. Have asked for help in math from: Math Lab___,Teacher___,Tutor___,Classmates___
15. If you were required to take a math course in the future which of the following free services, if any, would you use: Math Lab___, Teacher___, Tutor___, Classmates___

Appendix B

Male Data

SEX	AGE	DEGREE	MARS	COURSES BEFORE 1ST MATH	HIGHEST H.S. MATH COURSE	FIRST COLLEGE MATH	MOST DIFFICULT SUBJECT	AMOUNT OF MATH HELP
M	21	CRIM JUST	16		ALG 2	92	M	2
M	21	UNDEC	18	0	TRIG	102	E	2
M	32		22	2	TRIG	96	E	2
M	22	ENG	24	2	TRIG	92	E	4
M	25	ENG	25	0	GEOM	114	E	5
M	21	UNDEC	29	0	ALG 2	102	S	3
M	54	QUAL	30	0	ALG 2	102	E	0
M	19	LIB ARTS	30	0	PRE CALC	113	H	0
M	29	COMP INF	31	0	PRE CALC	113	M	8
M	18	BUS MAN	33	1	TRIG	102	S	1
M	18	NOT SURE	34		GEOM	96	H	2
M	29	QUAL ASS	35	7	ALG 1	114	E	3
M	19	CRIM JUST	36	0	ALG 1	96	M	5
M	23	CRIM JUST	37	0	GEOM	92	H	2
M	21	CRIM JUST	37	3	GEOM		M	2
M	20	NOT SHN	37	1	GEOM	96	M	3
M	21	FIRE TECH	38	3	BAS M	92	M	3
M	35	BUS FIN	39		ALG 2	96	E	0
M		ENG	40		BAS M	92	E	6
M	29	ENG	41	1	BAS M	92	E	2
M	19	FIRE TECH	41	2	ALG 2	92	E	1
M	21	NOT SURE	41	2	ALG 2	92	E	2
M	27	ENG	42	0	GEOM	96	M	2
M	32	MANUF	45	0	ALG 2	92	E	3
M		LIB ARTS	47		PRE CALC	96	E	5
M	18		48		GEOM	96	M	2
M	18	ENG	48	1	ALG 1	92	M	2
M	23	ENG	49	1	ALG 2	92	H	2
M	18	FIRE TECH	50	0	TRIG	96	E	3
M	20		52	2	TRIG	96	E	3
M	43	NOT SURE	52		ALG 2		M	2
M	21	CRIM JUST	53	2	ALG 2		M	2
M	25	LIB ARTS	59	15	GEOM		M	4
M	28	HUM SERV	64		BAS M	96	M	2
M	32	ENG	71	0	ALG 2	96	E	1
M		BUS	74	15	ALG 1		M	4

Appendix B

Female Data

SEX	AGE	DEGREE	MARS	COURSES BEFORE 1ST MATH	HIGHEST H.S. MATH COURSE	FIRST COLLEGE MATH	MOST DIFFICULT SUBJECT	AMOUNT OF MATH HELP
F	29	NURS	18	0	TRIG		H	3
F	53	MED INS	23		ALG 2		H	2
F	25	OFF AM	23	0	ALG 1	92	H	0
F	19	NOT SURE	23	3	ALG 2	92	M	6
F	36	BUS ADM	24	6	CALC	96	E	4
F	31	LEG ASST	25	3	ALG 2	92	E	0
F	21	CRIM JUST	29	0	PRE CALC	96	S	7
F	41	BUS MANG	29	0	ALG 1	92	E	0
F	18		32		PRE CALC	96	S	5
F	18	NOT SURE	32		ALG 1	96	M	6
F	18	EARLY ED	32		GEOM	96	M	1
F	21	HOSP MAN	33	6	GEOM		E	5
F	18	LIB ARTS	33	7	ALG 2	106	M	2
F	19	EARLY ED	36	1	ALG 2	92	M	7
F	18		36		TRIG	96	E	3
F	39	NURS	37	1	GEOM	96	H	4
F	22	NURS	39	3	ALG 2		S	4
F	18	SOC WORI	39	0	ALG 2	96	S	3
F	18	NOT SURE	39		GEOM	96	S	3
F	19		43	4	ALG 2	102	S	2
F	18	HUM SERV	43	0	ALG 1	92	M	3
F	29	HUM SERV	44	1	BAS M	92	S	4
F	34	ACCT	46		ALG 2		H	2
F	34	NURS	46	2	ALG 2	96	E	8
F	18	NOT SURE	46	0	ALG 2	96	H	4
F	53		46				M	1
F	20	HOT MAN	47	1	ALG 2		M	1
F	21	LIB ARTS	48		GEOM	92	S	2
F	42	OFF ADM	49	0	ALG 1	96	S	4
F		NOT SHN	49	0	BAS M		E	1
F	30	MED INS	49		BAS M		H	6
F	18	CUL ARTS	50	0	ALG 1	92	M	6
F	37	NURS	50	1	BAS M	92	S	7

Appendix B

Female Data

SEX	AGE	DEGREE	MARS	COURSES BEFORE 1ST MATH	HIGHEST H.S. MATH COURSE	FIRST COLLEGE MATH	MOST DIFFICULT SUBJECT	AMOUNT OF MATH HELP
F	21	NOT SURE	50	8	TRIG	106	M	4
F	25	NURS	50		ALG 2		M	3
F	18	NURS	50	0	ALG 1	102	M	4
F	20	LIB ARTS	52	0	ALG 2	92	E	3
F	41	HUM SERV	53	2	BAS M	92	M	6
F	20	NOT SURE	54	4	BAS M	92	H	5
F	19	NOT SURE	55	4	TRIG		M	2
F	21	NURS	57	3	GEOM		M	4
F	20	LIB ARTS	58	0	TRIG	96	S	4
F	38	NURS	58	0	BAS M	92	H	3
F	19	NOT SURE	58	1	ALG 2	96	E	2
F	25	NURS	60	5	BAS M	92	S	2
F	18	EDUC	60	0	ALG 2	92	M	5
F	20	OFF ADM	62	2	ALG 1	96	H	3
F	18	HUM SERV	62	0	ALG 2	92	M	4
F	35	NURS	63	10	ALG 2	96	S	3
F	25		67	2	ALG 2	92	H	1
F	37	NUTRIT	69	1	BAS M	96	M	4
F	33	DRUG COL	70	15	ALG 2		S	3
F	42	EARLY ED	74	15	BAS M	92	M	4
F	22	LIB ARTS	75	4	BAS M	92	M	3

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