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ABSTRACT

A study examined the relationship between math anxiety and selected demographic characteristics. Surveys were administered to 1,152 students in vocational-technical and comprehensive schools in 13 New Jersey school districts. The survey instrument included an attitude scale and a brief math test designed to evoke feelings of math anxiety in respondents. The responses of single parents and students enrolled in nontraditional career preparation programs were compared to those of childless students enrolled in comprehensive high schools. The single parents and students enrolled in nontraditional programs expressed higher levels of math anxiety than did their childless counterparts enrolled in traditional career preparation programs. Level of math anxiety was significantly related to the following variables: age, parental status, marital status, race, income level, mother's occupation, and previous mathematics courses taken. Female students did not have higher levels of math anxiety than males until the late junior high school/early high school period, at which time females begin exhibiting more math anxiety than their male counterparts. Students whose mothers were not employed outside the home exhibited the lowest levels of math anxiety, thus confirming the importance of home participation and support to success in mathematics. (Twelve tables and the survey questionnaire are included. Contains 11 references.) (MN)

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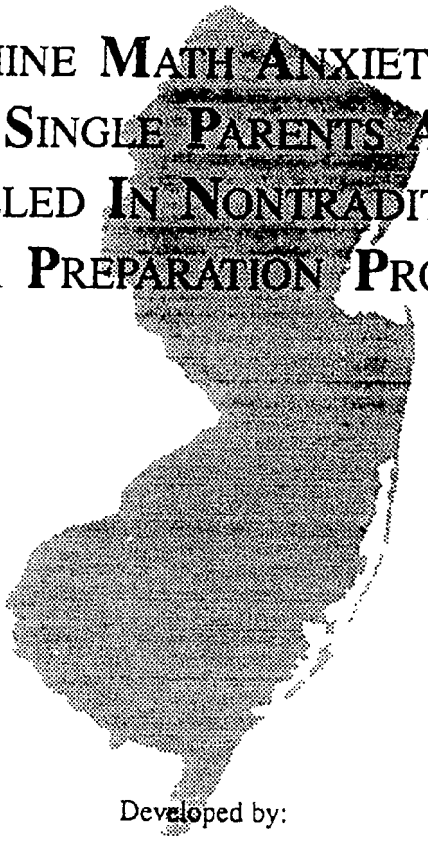

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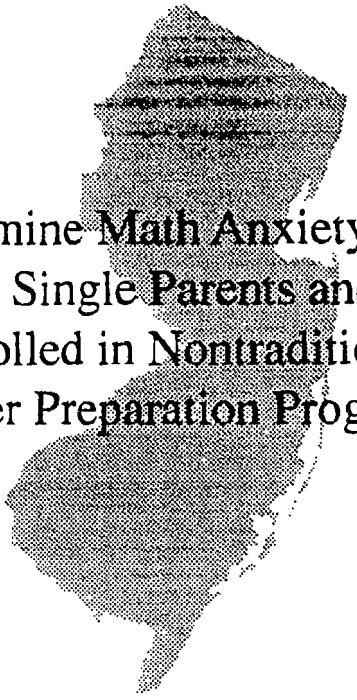

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INTRODUCTION

During the 1991-92 school year the New Jersey Department of Vocational Education sponsored a study to examine math anxiety as it affects the ability of women to enter the workforce. In order to learn more about the effect of math anxiety a study was conducted by the Life Skills Center at Montclair State to measure the level of anxiety expressed and to examine characteristics of the participant most likely to express feelings of math anxiety. Fear of math and working with mathematical concepts has been suggested as one of the factors which limit women in academic choices and career opportunities (Hunsley and Flessati, 1988). By understanding more about the characteristics of those suffering from math anxiety, programs can be developed to help students overcome their feelings of inadequacy.

The purpose of the study was to examine the feelings of math anxiety expressed by single parents and students enrolled in nontraditional career options. The participants were enrolled in public schools throughout the state.

REVIEW OF LITERATURE

Math anxiety has become a wide-spread concept used to explain the career choices which female students make and as an explanation of their lack of success in tasks which are math or science oriented. Commonly accepted has been the notion that women are not good at math or science and therefore they should select careers which do not require these skills. Anxiety has been defined as an emotional state characterized by an unpleasant, future oriented fear and dread which is not in proportion to the real threat. The person experiences feelings of uncertainty and helplessness (Lewis, 1970). Alexander and Martray (1989) define math anxiety as feelings of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations.

Researchers concerned with math anxiety tend to focus on either gender related aspects or previous math experience as related to feelings of math anxiety. The general public's perception that math anxiety is a female oriented problem has been only partially confirmed by research studies. Other factors which have been considered to be possible explanations for feelings of math anxiety are societal factors such as expectations of appropriate male and female roles and competencies and previous experiences in math oriented courses.

Math Anxiety and Gender

The most generally held finding is that gender is a determinant of math anxiety. Singer and Stake (1986) reported that mathematics is viewed as a male domain in which men are expected to excel and that society expects women to participate only at minimal levels. They have found that males and females view math differently in terms of usefulness in their own lives and that women students are less likely to have math-related career goals. Flessati and Jamieson (1991) state that the expression of math anxiety is more acceptable for females although females have been found to actually perform as well as or better than males in mathematics courses. Heher's (1988) thesis research, conducted at Salisbury State College, with college students found that the age and gender of the subject were not related to incidence or intensity of math anxiety.

Math Anxiety and Cultural Expectations

Many of the differences found in level of math anxiety may be related to cultural expectations rather than real differences in the abilities of males and females. Success in math is more likely to be related to the general self-definition of males than it is for females; in order to avoid conflicts in their definition of their self-role, females are likely to avoid math related situations (Singer and Stake, 1986; Flessati and Jamieson, 1991). Flessati and Jamieson (1991) go on to state that males may underreport their feelings of math anxiety because of cultural expectations that weakness in math is acceptable only for females.

Math Anxiety and Math Experiences

Because society has tended to view mathematics proficiency as a male domain, female students have been less likely to enroll in math courses, to view mathematics as important or useful to them, or to select math intensive careers (Singer and Stake, 1986). Students who have had successful experiences in math-related encounters were found to report lower math anxiety than those who have not experienced success in math (Flessati and Jamieson, 1991; Tocci and Engelhard, 1991). Further, some researchers have suggested that math anxiety is not necessarily related to gender but to poor preparation in mathematics (Hunsley and Flessati, 1988).

Grade Level Differences

Wigfield and Meece (1988) found that grade level was a significant factor in the level of math anxiety expressed by students. They found that students in the ninth grade reported the highest levels of math anxiety while those in the sixth grade the lowest levels. Engelhard (1990) stated that adolescence appears to be a critical age for studying gender differences. Results of his study on math anxiety indicated that up until the 8th grade gender differences related to feelings of math anxiety are minimal. However, by the time students completed high school significant differences were found between male and female students with females experiencing significantly higher levels of math anxiety.

Employment Status of Parents

Engelhard (1990) studied the relationship between math anxiety and the education level of the mother. He theorized that the mother was the most influential party in determining the child's linguistic skills and educational aspirations and that children with more educated mothers would have superior math skills to those with less educated mothers. Findings of his research indicated that among the subjects from Thailand there was a significant relationship between mother's education and math proficiency; however, among the US subjects no significant relationship was found. A study of college student's level of math anxiety by Alexander and Martray (1989) indicated that students whose mother's had some college education reported significantly higher levels of math anxiety than students whose mothers did not have any college education. Students whose fathers were professionally employed were found to be lower in math anxiety than those whose fathers were laborers.

Most research in the area of math anxiety has concentrated on gender. Authorities on math anxiety suggest that other characteristics of the student need to be examined in order to plan intervention programs more effectively. Tocci and Engelhard (1991) have stated that research emphasis and program planning need to consider how attitudes toward math are formed, how these attitudes change over time, and how these attitudes are related to gender, race, and social class. They state that intervention programs can be developed which will increase student achievement and increase participation of both males and females in math (Tocci and Engelhard, 1991). Information which would help counselors in identifying students most likely to suffer from math anxiety could facilitate the development of desensitizing intervention programs, more effective curriculum assignments, and improved counseling and guidance (Suiss and Edwards, 1982).

METHOD OF STUDY

This study was conducted to examine relationships between math anxiety and selected demographic variables. Math anxiety has been considered to be a deterrent to women interested in pursuing careers which required math proficiency. The research questions to be examined were

(1) Is there a relationship between level of math anxiety and gender?
(2) Do single parent students experience more anxiety than other students?
(3) Is there a difference in the level of math anxiety expressed by students of different age groups?
(4) Are students enrolled in nontraditional training programs different from students in traditional training programs in their level of math anxiety?

A survey was used to collect the data. Coordinators of gender equity training programs in school districts throughout New Jersey were asked to administer a math anxiety survey to students in classes other than mathematics. The data collection instrument was an adaptation of the Fennema-Sherman and Confidence Scale which was used by Heher (1988) in the study of math anxiety among college students. The original instrument consisting of 24 math anxiety questions was pretested on college students at Montclair State College and shortened to ten Likert-type statements on which the student indicated feelings of math anxiety.

Population and Sample

The sample consisted of 1152 students in thirteen school districts. A quota sampling technique was used to select a sample which included single parent, nontraditional students, and 9th and 12th grade students in general academic programs. Because the questionnaire was administered in a classroom situation, all students who were enrolled in the class were included in the sample regardless of their demographic characteristics. Classes were selected by the coordinators which were likely to include the largest groups of the target populations. Students who described themselves as parents, step parents, or foster parents and who were single, divorced, widowed, or separated were considered to be single parents. Two hundred and fifty students were in this group. Ninety-nine students described themselves as single and parents. Teachers were asked to administer the instrument to students enrolled in general academic programs. The following number of students were included at each grade level: 9th graders, 333 students; 10th graders, 193 students; 11th graders, 110 students; and 12th graders, 294 students. The nontraditional student sample consisted of 330 students.

Data Collection

The data collection instrument consisted of two parts. The students were first asked to take a ten problem math test in five minutes. The problems included addition, subtraction, multiplication, division, spatial relations, and logical thinking problems. The problems ranged from the simple to the more difficult. After five minutes the monitor collected the test and asked the students to complete a math anxiety test and a questionnaire which included a series of demographic questions. The second part of the test required approximately 15 minutes for the respondents to complete.

The math anxiety portion of the instrument was an adaptation of the Fennema-Sherman Math Anxiety test reported by Heher (1988). The instrument used by Heher included twenty four questions concerning the students feelings of math anxiety. Hehrer reported a split-half reliability of .89 on the Fennema-Sherman Math Anxiety test. Because the instrument for this research project needed to be shortened so that it could be completed in ten to fifteen minutes, the ten items which exhibited the greatest variability of response on the pre-test were included on the final test. The instrument was pretested on students at Montclair State College. A split-half reliability test on the ten item math anxiety test was .651.

The math portion of the test was not scored and was administered only to allow the participants to experience math anxiety in the same time period that they were describing their feelings of math confidence. No attempt was made to assess the student's level of math competence.

Methods of Data Analysis

Data were examined by means of frequency and percentage distributions. Feelings of math anxiety were measured with a Likert-type scale. Relationships between level of math confidence and other participant characteristics were analysed with Chi-Square analysis.

FINDINGS

During the 1991-92 academic year, 1152 students in thirteen school districts throughout New Jersey participated in the study. The participants group included single parents, students in general academic programs from the 9th to 12th grade, and students preparing for traditional and nontraditional careers.

The results of the analysis of the findings are presented in three parts: (1) demographic information; (2) test variables; and (3) relationship between the test variables, the students feelings of math confidence, and demographic characteristics. Demographic data is presented in Table I showing the frequency and percentage of the sample for each variable. The test variables, feelings of math anxiety, grade received in last math course, and math courses taken, are show in Table 2. The relationships between math confidence, math grade received, and feelings of confidence when taking nonmath tests and the demographic variables are shown on contingency tables. Levels of significance between these variables was measured by Chi Square analysis. Findings at the .05 level of significance were accepted as significant relationships and those at the .01 level as highly significant.

Demographic Information

Each subject was asked to complete a questionnaire requesting demographic information. The purpose of collecting this data was to examine how these factors might be related to feelings of math anxiety for the target sample groups.

The sample consisted of 51 percent male, 450 subjects, and 49 percent female, 428 subjects. They ranged from 9th grade to 12th grade, with the majority of the students in the 9th and 12th grades. The target sample groups were those in the 9th and 12th grades. Because the data was collected in classroom situations, other grade levels were sometimes included. The largest group (n=333), 33 per cent of the sample were in the 9th grade and 29 per cent (n=294) were in the 12th grade. The age of the sample ranged from 12 to more than 20 years of age, with a median age of 15 years. The 17 year old respondents formed the largest portion of the group and comprised 20 per cent of the sample. The smallest groups were those in the 19 year old group. The majority, 34 percent, of the participants were Caucasian. The second largest group, 25 percent, were African Americans. Hispanic American participants formed the third largest group and comprised 13 per cent of the sample. Ten per cent of the sample were in the Asian and Native American groups. The family income of the subjects participating in the study ranged from less than $21,000 to over $90,000 per year. The largest group, 26 per cent, reported family incomes of less than $21,000 per year. Forty eight per cent had incomes of less than $31,000 per year. See Table 1 for distribution of the sample by gender, grade level, age, racial, and family income characteristics of the sample.

Table 1. Gender, grade, age, and racial, and income characteristics of sample. n=1152

	f	%		f	%
Gender			Race		
male	450	51	Caucasian	353	34
female	428	49	African American	256	25
			Hispanic	131	13
Grade			Asian	100	10
9th grade	333	33	Native American	95	9
10th grade	193	19			
11th grade	110	11	Income		
12th grade	294	29	<$21,000	272	26
			21-30,000	236	22
Age			31-40,000	141	13
12 years	166	15	41-50,000	119	11
13 years	137	13	51-60,000	90	9
14 years	157	14	61-70,000	68	6
15 years	136	13	71-80,000	44	4
16 years	105	10	81-90,000	26	2
17 years	215	20	>$90,000	62	6
18 years	91	8			
19 years	20	2			
>20 years	59	5			

The participants included those who were not parents, 61 percent, and those who described themselves as parents, step parents, or foster parents. Thirty-two percent of the group stated that they were parents. The majority of the participants were single, 62 per cent, while 11 per cent classified themselves as married. The remainder the the sample were either divorced, widowed, or separated. The researcher suspects that the students were describing their family situation rather than their parental status in some situations. Thirty percent of the students described their Mother's occupation as professional. The second most prevalent occupation of mothers was managerial, 17 per cent, followed by service, self employed, homemaker and blue collar. Nine per cent of the Mothers were described as unemployed. The Father's of the largest group, 34 per cent, were employed as professionals. The second largest group of Fathers, 26 per cent, were employed in managerial positions. Thirteen percent of the Fathers were self employed, 10 per cent were in service and blue collar positions respectively, and four per cent were classed as not employed. Students were asked to indicate if their career choice was traditional or nontraditional for their gender. Fifty seven per cent of the students were enrolled in traditional career preparation choices and 43 percent in nontraditional careers. See Table 2.

Table 2. Parental status, marital status, mother's occupation, father's occupation and career choice for sample group. n=1152

Parental Status	f	%	Mother's Occupation	f	%
not a parent	625	61	professional	312	30
parent	201	20	managerial	172	17
step parent	61	6	self-employed	138	13
foster parent	65	6	service	147	14
			blue collar	76	7
Marital Status			homemaker	94	9
single	640	62	not employed	98	9
married	117	11			
divorced	88	9	Father's Occupation		
widowed	50	5	professional	349	34
separated	57	6	managerial	272	26
other	81	8	self-employed	132	13
			service	107	10
Career			blue collar	105	10
traditional	487	57	homemaker	20	2
nontraditional	361	43	not employed	46	4

Test Variables

The dependent variable, math anxiety, and the independent variables, math grade, previous math courses, and non math test anxiety were examined. Following are the frequency and percentage distributions for each.

The majority of the students, 73 per cent, earned a grade of A or B in the last math course in which they were enrolled. Three per cent indicated that they had failed their most recent math course. Students were asked to indicate each of the math courses they had completed with a grade of D or better. Fifty four per cent of the students had completed introductory algebra, while 49 per cent had completed intermediate algebra. College prep math had been taken by 48 per cent of the participants, and geometry had been completed by 40 per cent. Trigonometry, Calculus, Statistics, and Business Math were completed by fewer than 30 per cent of the students. See Table 3.

Table 3. Math grade and Math courses completed by participants. n=1152

	f	%
Math Grade		
A	303	30
B	427	43
C	162	16
D	80	8
F	30	3
Math Courses Completed		
College Prep Math	434	48
Intro. Algebra	475	54
Inter. Algebra	409	49
Geometry	323	40
Trigonometry	163	22
Calculus	127	19
Statistics	132	22
Business Math	163	33

Reported Non Math Test Confidence

Student feelings about taking tests in subjects other than math were measured by a single ordinal level question in which the student described his/her reaction as worried, somewhat worried, ambivalent, somewhat carefree, or carefree. The answer was scored from one to five with worried (1) being the least positive and carefree (5) being the most positive response.

The student test anxiety scores ranged from worried to carefree with 30 percent of the students in the somewhat worried group. Twenty five per cent of the students stated that they were carefree while 25 per cent indicated that they were somewhat carefree when taking non-math tests. The actual scores ranged from 1 to 5 with a mean score of 2.98. See Table 4 for the distribution of students reported non-math test anxiety.

Table 4. Distribution of student report non-math test confidence. n=1152

Non-Math Test Confidence	f	%
worried	121	11
somewhat worried	363	30
ambivalent	241	22
somewhat carefree	278	25
carefree	141	13

Math Anxiety

Math anxiety was measured with an ordinal level Likert-type scale in which the respondent was asked to indicate feelings about math on ten different questions. The respondents indicated their degree of math anxiety by selecting the response category which most appropriately described their feelings. The response categories consisted of a five point scale ranging from strongly agree to strongly disagree. The questions were arranged in such a way that on half the statements the response indicating the most anxious feeling was on the left side of the answer sheet and in the other the most anxious response was on the right side. The instrument was scored from one to five with five being the most anxious response. The responses were summed in order to attain a level of math anxiety score. The students math anxiety scores were divided into five groups. The respondents exhibiting the lowest level of anxiety were classed as Low Math Anxiety, those with the highest levels of math anxiety as High Math Anxiety, etc.

The majority of the students reported moderate levels of math anxiety. Forty six per cent of the students were in the moderate math anxiety group while 24 per cent exhibited moderately low math anxiety. Eight per cent of the students were in the low math anxiety group while three per cent were in the high math anxiety group. The remaining group, 19 percent, were in the moderately high math anxiety group. Math anxiety scores ranged from 1 to 5 with a mean math anxiety score of 3.17 (moderate math anxiety). See Table 5 for level of math anxiety.

Table 5. Level of math anxiety. n=1152

Level of Math Anxiety	f	%
Low	92	8
Moderately Low	263	24
Moderate	519	46
Moderately High	210	19
High	35	3

Relationships Between Variables

Math Anxiety and Demographic Variables

Chi-Square analysis was performed on the participants characteristics by level of math anxiety. See Table 6. The participants feelings of math anxiety were found to be significantly related to the age, parental status, marital status, race, family income level, Mother's occupation, career choice, and grade in last math course. Additionally, previous courses in college prep math, introductory algebra, and intermediate algebra were significantly related to feelings of math confidence. No significant relationships were found between math anxiety and the following demographic characteristics: gender, Father's occupation, geometry, trigonometry, calculus, statistics, or business math courses.

Age was found to be significantly related to feelings of math anxiety. The lowest levels of math anxiety were found among those who were 14 and 17 years of age groups. The most math anxious were those in the 12 year old group. Parental status and marital status were also found to have significant relationships to feelings of math anxiety. Students who were not parents and who were single were in the most confident math group. Caucasian respondents exhibited the lowest levels of math anxiety. In terms of family income those who reported family incomes of $81-90,000 were the least anxious while those in the $21-30,000 group were the most anxious.

The occupation of the participants Mother was found to be significantly related to feelings of math anxiety; however, the Father's occupations was not found to be related to feelings of math anxiety. Students who had mothers who were homemakers were found to exhibit the lowest levels of math anxiety. Children whose mothers were in managerial positions or who were self-employed exhibited higher levels of math anxiety. Interestingly, students who listed their Father's occupation as homemaker were also among the most confident. However, this was not a significant relationship.

Students who described their career choice as traditional for their gender were found to be significantly lower in math anxiety than those who listed their career choice as nontraditional for their gender.

Table 6. Chi-square analysis of participant characteristics by level of math anxiety.

		Math Anxiety Level %					
Participant Characteristics:	n	High	M.H.	Mod.	M.L.	Low	$\chi 2$
Age:							
12-13	303	4	24	59	12	1	92.79***
14-15	293	2	15	41	28	13	
16-17	318	2	19	40	30	9	
18-19	107	3	11	50	26	9	
20 yrs.	58	5	14	43	22	16	
Gender							
male	450	4	16	43	28	10	2.06
female	428	3	19	43	26	11	
Parental Status:							
not a parent	625	3	17	41	28	11	56.56***
parent	201	3	18	48	22	8	
step parent	61	2	25	66	8	0	
foster parent	65	5	15	71	9	0	
other	72	3	22	51	19	4	
Marital Status:							
single	640	3	14	41	29	12	88.56***
married	117	5	27	55	9	3	
divorced	88	3	23	59	13	2	
widowed	50	2	30	58	8	2	
separated	57	0	12	58	23	7	
Race:							
Caucasian	353	5	17	38	27	14	59.28***
African American	256	3	21	52	19	5	
Hispanic	131	2	20	53	21	5	
Asian	100	1	12	62	17	8	
Native American	100	3	19	51	24	3	
Income:							
<$30,000	508	3	22	48	20	7	26.33**
$31-50,000	260	2	17	48	25	8	
$51-70,000	157	3	13	47	25	12	
>$70,000	126	4	11	39	34	12	
Mother's Occupation:							
professional	312	3	16	46	28	7	47.48**
managerial	172	3	21	53	18	5	
self-employed	138	1	20	58	18	4	
service	147	5	18	44	24	8	
blue collar	76	3	21	43	21	12	
homemaker	93	0	16	38	26	18	
not employed	97	2	18	37	27	13	
Father's Occupation							
professional	349	3	18	45	24	10	32.11
managerial	272	1	24	47	21	7	
self-employed	132	4	13	50	27	6	
service	107	2	18	53	18	9	
blue collar	105	4	14	42	32	8	
homemaker	19	5	5	42	26	21	
not employed	45	3	18	47	24	9	

Table 6. (continued) Chi-square analysis of participant characteristics by level of math anxiety.

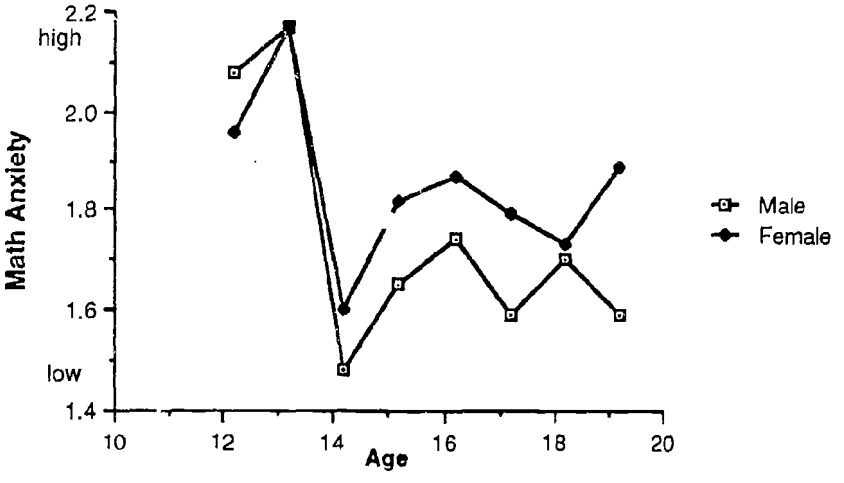
		Math Anxiety Level %					
Participant Characteristics:	n	High	M.H.	Mod.	M.L.	Low	$\chi 2$
Courses:							
College Prep. Math	434	2	15	40	29	13	25.72***
Intro. Algebra	475	1	15	40	31	12	28.19***
Inter. Algebra	409	1	14	42	29	13	23.73***
Geometry	323	2	14	42	29	13	8.95
Trigonometry	163	2	14	44	27	12	1.59
Calculus	127	2	13	54	21	9	7.37
Statistics	132	1	14	47	27	11	1.98
Business Math	163	1	14	41	31	13	2.16

***sig.>.0001, **sig.>.001

Gender and Math Anxiety

Chi Square analysis of gender as related to feelings of math anxiety indicated no significant relationship ($\chi 2$=2.06, p.7249). See Table 6. When male and female students were examined by age the differences in their feelings of math anxiety became more apparent. At age twelve female students expressed lower levels of math anxiety than male students, at age thirteen the two groups were the same, and by age fourteen boys became more math confident (lower in math anxiety). The feeling of confidence expressed by males was consistently higher than that of females until age twenty. The mean math confidence score for males (M3.399) was significantly higher (F 5.036, p.0252) than that for females (M3.263) in the 14 to 19 year old range. This finding supports research findings that females are less confident of their abilities in math; in this study the age at which they exhibited the most vulnerability to feelings of inadequacy was the twelve to thirteen years of age period. After age fourteen the female student exhibited greater math anxiety than the male students. Englehard (1990), in a study relating math anxiety to age, found that up until the 8th grade that differences between males and females were minimal but that significant differences were found by the end of high school. See Figure 1 for math confidence as related to gender and age.

Fig. 1 Math Anxiety as Related to Gender and Age



Single Parents and Math Anxiety

Single parents were found to be significantly less confident than those who were not single parents. This finding must be accepted with caution as some students who were twelve, thirteen, and fourteen years old classified themselves as single parents, foster parents, or step parents. The researcher believes some students were describing their personal family situation rather than their parental and marital status. See Table 7 for math anxiety related to single parent status.

Table 7 Math anxiety and single parents. n=931

		%					
	n	High	M.High	Moderate	M.Low	Low	$\chi 2$
Single Parents							
yes	231	3	18	55	19	6	13.9**
no	700	3	17	43	26	10	

**sig.>.01

Grade Level and Math Anxiety

Students generally became less anxious as they progressed in terms of grade level. However, 9th graders did express high levels of confidence. Tenth through 12th graders progressed from more anxious to less anxious. Students in the 9th grade are generally completing instruction in general mathematics and are entering more advanced classes. Ninth grade students may not have been exposed to sufficiently high levels of math instruction to be fully aware of their level of proficiency. See Table 8 for level of math anxiety related to grade level.

Table 8 Chi square analysis of math anxiety related to grade level.

		%					
	n	High	M.High	Moderate	M.Low	Low	$\chi 2$
Grade							
9th	333	3	17	43	26	11	22.44***
10th	193	2	25	53	15	5	
11th	110	3	20	54	20	4	
12th	294	3	15	41	30	11	
other	74	5	19	49	19	8	

***sig.>.001

Traditional and Nontraditional Students and Math Anxiety

Students enrolled in traditional career choices were compared to students who were in nontraditional career choices. Students in traditional career options were significantly less anxious about their abilities in math than those in nontraditional career options. See Table 9 for math anxiety for traditional and nontraditional students.

Table 9. Chi square analysis for math anxiety and traditional/nontraditional career choice.

	n	% High	M.High	Moderate	M.Low	Low	$\chi 2$
Career Choice							
traditional	487	2	15	44	30	9	10.87*
nontrad.	360	3	21	44	22	10	

*sig.>.05

Previous Math Grade and Math Anxiety

The grade the student received in the most recently completed math course was directly related to feelings of math anxiety. Those receiving high grades exhibited feelings of confidence while those who received low or failing grades were significantly more likely to be low in math confidence.

Table 10. Chi square analysis of math anxiety as related to grade in math course.

Grade	n	% High	M.High	Mod.	M.Low	Low	$\chi 2$
A	303	1	15	41	30	14	59.86***
B	427	3	19	44	26	8	
C	161	2	14	63	20	2	
D	79	4	28	53	13	3	
F	28	7	21	50	14	7	

***sig.>.001

Math Courses and Math Anxiety

Taking math courses was also important in reducing math anxiety. Students who indicated that they had completed courses in college prep math, introductory algebra, and intermediate algebra were all more confident than those who had not taken these courses.

Table 11. Chi square analysis of relationship between level of math anxiety and mathematics courses completed.

	n	% High	M.High	Moderate	M.Low	Low	$\chi 2$
Courses							
Col.Prep	434	2	15	40	29	13	25.72***
Intro.Alg	475	1	15	40	31	12	28.19***
Inter.Alg	409	1	14	42	29	13	23.73***
Geo	323	2	14	42	29	13	8.95
Trig	163	2	14	44	27	12	1.59
Calculus	127	2	13	54	21	9	7.37
Statistics	132	1	14	47	27	11	1.98
Bus.Mat	163	1	14	41	31	13	2.16

***sig.>.001

Non Math Test Anxiety and Math Anxiety

A strong relationship was found between math anxiety and stated feelings of anxiety when taking non math tests. Students who were anxious about math were also anxious about other tests. Those students who were most confident about math were most likely to be carefree about non math tests.

Table 12. Chi-Square analysis of relationship between math anxiety and non math test anxiety.

	n	% High	M.High	Mod.	M.Low	Low	$\chi 2$
Non-math anxiety							
worried	121	10	21	52	15	2	55.2***
s.worried	332	2	20	47	24	7	
ambival	241	0	20	48	23	9	
s.carefree	278	3	16	46	27	8	
carefree	140	3	16	40	24	17	

***Sig.>.001

Discussion and Conclusions

The purpose of the study was to examine math anxiety among high school students as related to selected demographic characteristics. Single parents and nontraditional student groups were compared to students enrolled in comprehensive high schools. Both single parents and students enrolled in nontraditional programs expressed higher levels of math anxiety than students who were single and those enrolled in traditional career preparation programs. Review of previous research indicated that math anxiety has been found to be related to gender differences and the participants previous math experiences. Additional information about the characteristics of students suffering from math anxiety is important to the planning of intervention programs.

Findings of the research indicate that the majority of the students were in the moderate to moderately low math anxiety group: level of math anxiety was significantly related to their age, parental status, marital status, race, income level, mother's occupation, and the previous courses they had taken in mathematics. A search of the literature had indicated that although females have sometimes been found to be more likely to suffer from math anxiety than males, that the finding was not universally found by researchers.

This study examined the level of math anxiety expressed as related to age and gender. Female students appear to be similar to male students through the junior high school age period. As they enter higher level math courses in the later stages of junior high and then into high school, females start to exhibit more math anxiety than male students. Several researchers have suggested that females are socialized in our society to expect that they will not be good at math and that proficiency in math is not expected of females. As they reach higher level math courses which are more demanding, they may not exert sufficient effort to overcome their fears and thus may not choose to enroll in higher level math courses. This tendency on the part of females severely limits future career options in technical fields which require math proficiency.

Several research studies have found that although female students earn grades comparable or superior to male students, they still express more anxiety related to math and are less likely to enroll in math courses and select math and science oriented careers. Females do not see

proficiency in math as a part of their self definition. This research found that as females become older they are more likely to express feelings of math anxiety. Whether these feelings are really greater or they are merely reflecting culturally accepted norms for female behavior is not clear. However, feelings of math anxiety are limiting to the types of career choices which female students make. Findings relating to math anxiety and other demographic characteristics need to be used to develop programs which will help female students overcome feelings of math anxiety and to thus more positively consider careers which require these types of proficiencies.

Single parents were examined as a separate subgroup in terms of their feelings of math anxiety. Those who were single parents expressed higher feelings of math anxiety than those who were not single parents. Findings related to single parent status were limited because in some cases the students appeared to be indicating their family situation rather than their parental status. However, programs to overcome feelings of math anxiety are particularly important for the single parent group. They are faced with the problem of supporting their family alone. All potential career options need to be open to this group. Feelings of math anxiety which may prevent them from seeking higher level careers which may be both personally and financially rewarding need to be overcome in order for these groups to make a significant contribution to the workforce.

Students whose mothers were not employed outside the home were found to exhibit the lowest levels of math anxiety. This finding is consistent with research findings which show that home participation and support are important to success in mathematics. Without support at home, learning math is a task which students sometimes find to be overwhelming. At a time in history when more mothers are entering the workforce, schools will need to assume a more active role in providing the type of emotional support which mothers have been able to provide in the past. Many students give up on math because they are not able to deal with the frustration of working through an abstract concept. Student support programs need to be considered. These might include support through clubs in schools, girl scouts, etc. Support could be provided in the form of after-school or call in programs to help students in their individual after school work. At the present time some employers have started providing assistance to the employee-parent to assist them in helping their children with school work (Shellenbarger, 1992). Such programs are at the experimental stage. However, in order for a larger number of children to succeed in math, creative programs will need to be considered. Such programs have potential in preparing students for a wider variety of career options and employers with a more capable workforce.

To enable females, who are becoming an increasingly large portion of the workforce, to contribute significantly in higher level management positions which require long-range planning and analysis of financial data as well as interpersonal management skills, women must overcome the perception that females are not expected to understand complex problems which require analytical skills. Businesses need a workforce who have mastered basic skills and in which the employees are willing to pursue challenges which are forthcoming. The confidence to address and work through challenging problems is a characteristic which has not been expected of most women because their positions have generally required simply facilitating someone else's work. In order for more women to successfully move into decision making roles, women must learn at a young age that having a challenging career is appropriate for women and that they must master basic skills in mathematics and critical thinking which will allow them to effectively perform in a wide variety of career options.

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Participating School Districts: Bayonne Public Schools, Essex County Vocational Technical School, Gloucester County Vocational Technical School, Irvington Public Schools, Mercer County Vocational Technical School, Middlesex County Vocational Technical School, Monmouth County Vocational Technical School, Newark Public Schools, Paramus Public Schools, Pinelands Regional School District, Salem County Vocational Technical School, and Somerset County Vocational Technical School .

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Appendix

ATTITUDE TOWARD MATH

PLEASE DO NOT WRITE IN THE GREEN SECTION OF YOUR ANSWER SHEET. You do not need to include your name.

Please indicate which response best describes how you feel when you take a test other than a test in mathematics.

11. When taking a test other than a test in mathematics, I feel:
    1. worried
    2. somewhat worried
    3. ambivalent
    4. somewhat carefree
    5. carefree

The following questions attempt to assess your attitude toward mathematics. Indicate as accurately as possible how you feel about each statement by marking the appropriate response on your answer sheet.

1. strongly disagree
2. disagree
3. uncertain
4. agree
5. strongly agree

12. Math doesn't scare me at all.

13. I have almost never been shaken up during a math test.

14. I have usually been at ease during math classes.

15. Mathematics usually makes me feel uncomfortable.

16. Mathematics makes me feel restless.

17. I get a sinking feeling when I think of trying to do a difficult math problem.

18. My mind goes blank and I am unable to think clearly when working math problems.

19. Mathematics makes me feel confused.

20. I am sure I could do advanced work in mathematics.

21. I am sure I can learn mathematics.

22. Please indicate your Gender.
    1. male
    2. female

23. Grade
    1. 7th grade
    2. 8th grade
    3. 9th grade
    4. 10th grade
    5. 11th grade
    6. 12th grade
    7. other

24. Age
    1. 12 years
    2. 13 years
    3. 14 years
    4. 15 years
    5. 16 years
    6. 17 years
    7. 18 years
    8. 19 years
    9. over 20 years of age

25. Please indicate your parental status.
    1. not a parent
    2. parent
    3. step parent
    4. foster parent
    5. other

26. Please indicate your marital status
    1. single
    2. married
    3. divorced
    4. widowed
    5. separated
    6. other

27. With which of the following groups do you most closely identify? (Please select only one)
    1. Caucasian, not Hispanic
    2. African-American
    3. Hispanic
    4. Asian
    5. Native American
    6. other

28. Which category best describes your annual family income?
    1. under $21,000
    2. $21-30,000
    3. $31-40,000
    4. $41-50,000
    5. $51-60,000
    6. $61-70,000
    7. $71-80,000
    8. $81-90,000
    9. over $90,000

29. What is the occupation of your mother/guardian?
    1. professional
    2. managerial
    3. self-employed
    4. service worker
    5. blue collar
    6. homemaker
    7. not employed outside the home

30. What is the occupation of your father/guardian?
    1. professional
    2. managerial
    3. self-employed
    4. service worker
    5. blue collar
    6. homemaker
    7. not employed outside the home

31. Is your job or career interest considered by others to be traditional or nontraditional for your gender? Ex. traditional: female nurse, male plumber
    nontraditional: male nurse, female plumber

    1. traditional for my gender
    2. nontraditional for my gender

32. Please indicate the grade you received in your most recent math course.
    1. A (90-100%)
    2. B (80-90%)
    3. C (70-80%)
    4. D (60-70%)
    5. F (below 60%)

Please indicate which of the following math courses you have completed with a grade of D or better.

	1. yes	2. no
33. college prep math		
34. introductory algebra		
35. intermediate algebra		
36. geometry		
37. trigonometry		
38. calculus		
39. statistics		
40. business math		

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