

MATHEMATICS ANXIETY AT CHIPPEWA VALLEY TECHNICAL COLLEGE

by

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ABSTRACT

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Mathematics anxiety is a problem for many people. It can have detrimental effects for college students including feelings of nervous tension, fear of rejection, and stress. This study examined the math anxiety levels for Chippewa Valley Technical College Students. It was found that the average level of math anxiety at CVTC for the survey sample is not significantly higher than other similar educational institutions. A moderately negative correlation was found between grade point average and level of math anxiety. A positive correlation was found between students' dislike of mathematics and math anxiety levels. Students also reported levels of anxiety associated with algebra, word problems, and studying.

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CHAPTER ONE

Introduction

Math Anxiety is an intense emotional feeling of anxiety that people have about their ability to understand and do mathematics. While math anxiety may be perceived as an excuse for poor math performance, it can be a valid, justifiable excuse as well.

“Anxiety usually manifests itself as a feeling that you will never understand this new math topic. It is a feeling of a complete mental block, a dead-end” (May, 2000,). William D. May, Ph.D., and author of the book, *So much data so little time*, gave this advice to a person who was unsure of his or her stage in the anxiety process. To overcome this uncertainty, people often take the easy road out and avoid the intimidating math class.

Much research has been done on this subject to include studies on psychological and physiological traits of people with math anxiety. Mark H. Ashcraft and Elizabeth P. Kirk, psychologists at Cleveland State University, performed multiple studies to find out more about this phenomenon. In the first experiment, Ashcraft and Kirk found that students with a high level of math anxiety enrolled in fewer math courses, received lower math grades, and scored worse on working-memory tests involving numbers than their peers did (Bower, 2001). Another experiment found that high math anxiety translates into poorer performance on an unconventional number-manipulation task that also taxed working memory. Earlier studies have found that math anxiety temporarily boosts heart rate and other physical indicators of worry, notes psychologist David C. Geary of the University of Missouri in Columbia.

Math anxiety has a real impact on peoples' academic choices. Students who are severely math anxious may opt for academic majors within the humanities, fine arts, or social sciences that require minimal coursework in mathematics (Chipman, cited in Zettle & Raines, 2000). In fact, the term *math anxiety* was formerly coined *math avoidance* (Royse & Rompf, 1992). Students also may be more likely to have negative attitudes toward mathematics-related activities such as those encountered when working with computers (Gressard & Loyd, 1987) or statistics (Adams & Holcomb, 1986); and if they become elementary school teachers, may spend less time teaching mathematics than their less anxious colleagues (Trice & Ogden, 1987).

Math anxiety is measured in two ways. The first is by a self examination and evaluation of anxiety when presented with various types of mathematical situations, possibly with the help of a pre-fabricated anxiety scale. A degree of anxiety is determined and usually falls under categories such as “very anxious”, “moderately anxious”, and so on. The other method of measuring anxiety is by a second party, who is usually someone who is trained to see physiological signs of anxiety and the actions associated with them. Psychiatrists and psychologists are an ideal outside opinion to diagnose such a problem.

This research project aims to identify the level of math anxiety in math students at Chippewa Valley Technical College.

Chippewa Valley Technical College

Chippewa Valley Technical College (CVTC), is located in the Chippewa Valley of northwestern Wisconsin, and has its main campus located in Eau Claire, WI. CVTC is one of 16 technical colleges in Wisconsin, and is governed by the Wisconsin Technical College System. It has six campuses and enrolls about 5,000 credit students per year

(Chippewa Valley Technical College website, 2003). Some demographic information about the student body is as follows:

- Students range in age from 16 to 64
- 50% of CVTC students are 22 years of age or under
- 80% of students surveyed in 1998 stated that CVTC was their first choice

as a college

- About 2/3 of CVTC students work part-time or not at all
- Many students who work full-time take classes on a part-time basis. Other

reasons for enrolling as a part-time student include family responsibilities and/or the desire to go at a slower pace

- Approximately 60% of full-time, first-time degree-seeking students

receive financial aid. (CVTC website, 2003)

CVTC's main campus is located in Eau Claire, which houses a total of three campuses. Chippewa Falls, Menomonie, Neillsville, and River Falls are also homes to other CVTC campuses. The college offers roughly 62 Associate degree and Technical diploma programs along with about 33 short-term training certificates (CVTC Online catalog). All programs are categorized into the following 11 broader categories:

Business, Computer, Health, Leadership/Manufacturing/Quality, Manufacturing and Agriculture, Mechanical, Personal and Consumer, Public Safety, Service, Transportation and Construction, and Other.

Many of the programs at CVTC require some type of math class or background level of math. For example, the Mechanical CAD Operator Certificate (TC-606-1) requires that 25% of its classes be math. One can choose from applied algebra (3 credits), applied geometry and trigonometry (2 credits), and/or technical math (5 credits).

Statement of the Problem

Math anxiety is a problem. It can affect peoples' everyday life, students' academic careers, and even contribute to stress, which is well known to cause many other problems.

Purpose of the Study

The purpose of this study was to identify the extent to which math anxiety among Chippewa Valley Technical College students in Wisconsin exists in autumn of 2002 by means of a survey.

Objective Questions

The following objective questions are to be answered:

1. How much math anxiety exists in math students at CVTC?
2. To what degree is math anxiety a problem for the college and the student?
3. What is the relationship between school performance and math anxiety?
4. What other demographic factors correlate with math anxiety?

Significance of the Study

1. If math anxiety can be identified in CVTC students, then remediation can take place.
2. Data for this study can be used to orientate instructors, counselors, administrators and support staff on math anxiety programs and strategies.
3. Specific programs may implement additional assistance.
4. Other technical colleges may find this information useful to apply math anxiety coping strategies with their students.
5. Educational administrators will have a better understanding of their student body.

Assumptions

The following assumptions are made with regard to this study:

1. Students will answer truthfully and honestly to a survey.
2. Data collected is not dependent on time of year obtained.

Limitations

The following limitations to the study are to be observed:

1. Data was collected from one campus location.
2. Data was collected in a relatively short period of time during a particular portion of the semester.
3. The age range of participants in the study varies.
4. The participants have different educational backgrounds.
5. The study will be restricted to CVTC math students. Students outside this college and inside but not in a math course will not be a part of the study and generalizations will not be made.

Definition of Terms

The following definitions are used throughout this paper:

CVTC – Chippewa Valley Technical College, a technical college located throughout the Chippewa Valley of Wisconsin in multiple campuses.

Math Anxiety – an intense emotional feeling of anxiety that people have about their ability to understand and do mathematics (Southwest Texas State University website, 2002).

CHAPTER TWO

Literature Review

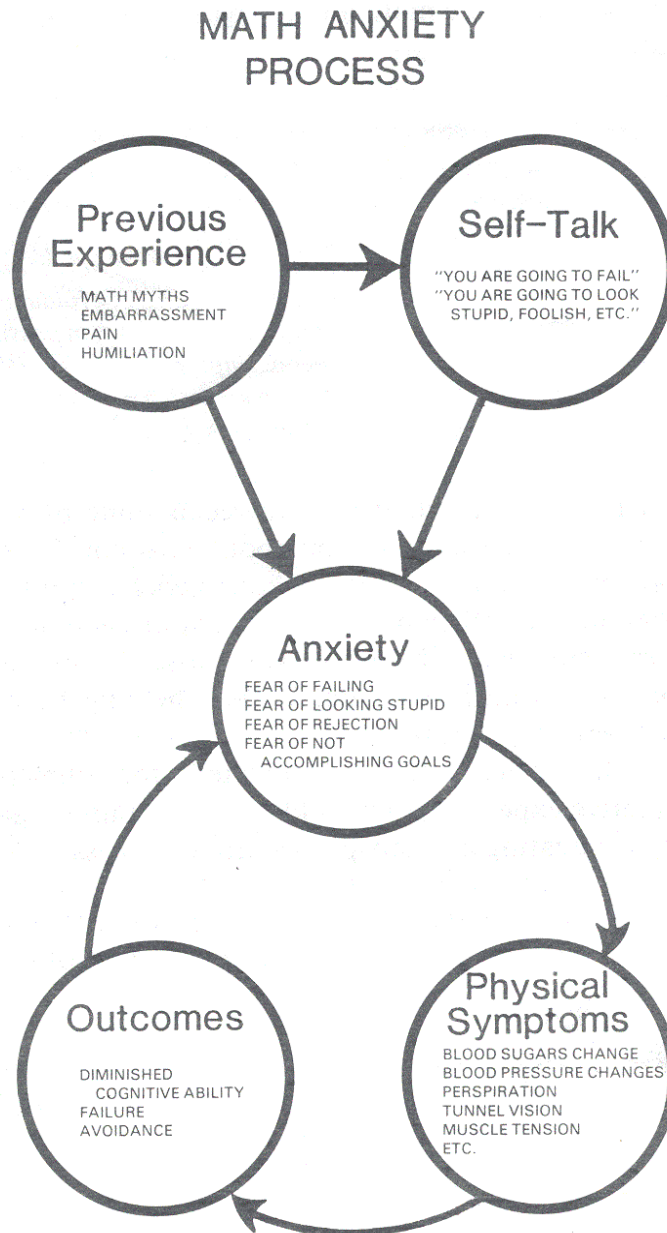
Introduction

This chapter will discuss some general content of math anxiety. Past documentation on this subject will be addressed and discussed, including prior research studies, journal articles, and book publications. Two types of literature will be presented: models of math anxiety, and causes of math anxiety.

Modeling Math Anxiety

The math anxiety process model (see Figure 1) developed by Dr. Charlie Mitchell in 1984, gives a good illustration of the math anxiety process. Previous experiences, including math myths, embarrassment, pain, and humiliation can all be direct or indirect sources for anxiety. Research about the sources of math anxiety will be discussed in the next section. The indirect path from previous experience includes a self-talk or self-doubt stage where the subject thinks negative thoughts about the anxiety-causing event. The anxiety stage is compiled of one or more fears that include, but is not limited to: fear of failing, fear of looking stupid, fear of rejection, and fear of not accomplishing goals. The anxiety in a person causes physical symptoms such as changes in blood sugar levels, blood pressure changes, perspiration, tunnel vision, muscle tension, and others. The physical symptoms lead to the outcomes stage, where a person may have diminished cognitive ability, failure to accomplish objectives, and avoidance. The outcomes stage can lead right back to the anxiety stage where various fears are surfaced. The process can then become circular, wherein an anxious subject can continue through exhausting cycles of the self-perpetuating anxiety process.

Figure 1: Math Anxiety Process (Mitchell, 1984)



Mitchell's Anxiety Model relates to this study in that many of the questions on the survey instrument use questions geared towards these same concepts described in the model. Questions on the survey are related to the same type of anxiety-related fears as

described above. Similar negative outcomes are also addressed in the survey that aim to narrow the source and level of mathematics anxiety.

Math Matters is an organization that was put together for the purpose of helping students develop a solid math foundation and prevent math anxiety. They exist today on the web and have an interactive CD-ROM tutorial that helps guide students through their problems. The following figure illustrates graphically how Math Matters interprets one's level of performance as a function of their level of anxiety.

Figure 2: Performance vs. Anxiety (Math Matters, 2002)



Peak performance occurs when anxiety optimally alerts the responses of the body. Some anxiety is good. Driving a car requires a low level of anxiety. However, as anxiety continues to increase, it interferes with performance until at the far right one is paralyzed by anxiety. Students with test anxiety describe their minds as going blank. Students with math anxiety are on the far right of the curve (Math Matters, 2002).

Causes of Math Anxiety

Adults remember math as being taught in an atmosphere of tension created by the emphasis on correct answers and especially by the demands of timed tests (Tobias, 1978). Often, math anxiety comes from societal barriers that are put up in elementary school. For example some young women are told that girls do not do math, or young African

Americans are told that blacks do not become engineers (Tobias, 1987). Math anxiety usually arises from a lack of confidence when working in mathematical situations. Many people incorrectly assume that math anxiety and an inability to be successful in mathematics are inherited from one's parents (Stuart, 2000).

Other sources of math anxiety may lie in the pure nature of mathematics itself. We can all agree that $3 + 4 = 7$. But what is $3 - 4$? In order for this answer to make sense, negative numbers had to be invented (Tyson, 2001). Similarly, we can all agree that half of 14 is 7, but what is half of 7? In order for this answer to make sense, division had to be invented to include fractions, another form of number (Tyson, 2001). Similar arguments can be made for the advent of many more types of numbers such as imaginary, irrational, transcendental, and complex, just to name a few. And this is where some anxiety about the subject may arise. As the content of math courses gets more in-depth and involved, a greater understanding of previous math content is required.

Several recent studies are cited here for possible sources of math anxiety.

An article titled *Factors associated with types of mathematics anxiety in college students* was published in the Journal for Research in Mathematics Education in 1995 by Kenneth C. Bessant of Brandon University in Manitoba. He investigated the interrelatedness of various types of mathematics anxiety with attitudes toward mathematics, learning preferences, study motives, and strategies. He used an 80-item version of MARS, the Mathematics Anxiety Ratings Scale, and found that there is a complex interaction pattern between attitudes toward mathematics and the following six MARS factors: general evaluation anxiety, everyday numerical anxiety, passive observation anxiety, performance anxiety, mathematics test anxiety, and problem-solving anxiety.

Another intriguing study, conducted by Carol Jackson and Jon Leffingwell over a three-semester time frame to find the roles that instructors play in creating math anxiety, yielded some interesting results. Sixteen percent of students experienced their first traumatic encounter with math in grades 3 or 4, 26% percent in high school, and 27% in college. Four factors that contributed to the anxiety producing situations are: difficulty of material, hostile instructor behavior, gender bias, and perception of instructors as insensitive or uncaring (Jackson & Leffingwell, 1999). Difficulty of material at this level was found to be working with parts of numbers, timed tests, and memorization of objects like multiplication tables. Hostile instructor behavior was found to be derogatory comments made by the instructor such as “Do not pretend to look smarter than you are; it makes you look stupid,” and “How many times do I have to tell you...?” Examples of gender bias are outlined here:

- Girls were ridiculed more overtly than boys when they asked for clarification.
- Teachers did not intervene when girls were verbally abused and belittled by their peers.

- Instructors told some females that girls do not need mathematics.
- Instructors repeated explanations more often to boys than to girls.

Examples of perception of instructors as insensitive and uncaring:

- Instructors did not respond to students' needs for clarification and tutoring.
- Instructors did not stop students from scape-goating and criticizing their peers.
- Instructors showed insensitivity to students' documented severe allergic reactions to chalk by frequently forcing them to write on the chalkboard.

- Instructors showed anger or disgust when students asked for help.

Of the 26% of students that had negative experiences in high school, the majority had them in grades 9 through 11. The aspects of instructor behavior that led to these negative experiences included angry behavior, unrealistic expectations, embarrassing students in front of peers, gender bias, and insensitive and uncaring attitudes. Twenty-seven percent of respondents reported that college was their starting point for mathematics-related stress. Causes of these stressors included communication and language barriers (often due to professors having English as a second language), insensitive and uncaring attitude of the instructor, quality of instruction, evaluation of instruction, gender bias, and age discrimination.

In a multinational study conducted by Cynthia Tocci and George Engelhard Jr. at Emory University in Georgia, statistically significant correlations were found between math anxiety and the following three variables: gender, achievement levels in mathematics, and parental support. Figures 3 and 4 give the Pearson correlations for the United States and Thailand, respectively (Tocci & Engelhard, 1991, p. 283):

Table 1: Pearson Correlations for U.S.

	Anxiety
Gender	-0.03 (p<0.05)
Achievement	-0.24 (p<0.01)
Parental Support	-0.19 (p<0.01)

Table 2: Pearson Correlations for Thailand

	Anxiety
Gender	-0.08 (p<0.01)
Achievement	-0.14 (p<0.01)
Parental Support	-0.10 (p<0.01)

These results show that there is relatively no correlation between gender and anxiety. A larger, yet still low correlation exists between parental support and anxiety. And the largest correlation of the three exists between achievement levels in mathematics and anxiety. This data also suggests that anxiety may be a complex function of many different variables that are interrelated. The Bessant study found that this was in fact true. Some of the variables include: attitudes toward mathematics, learning preferences, study motives and strategies, outside support, prior achievement in mathematics, affective components toward learning math, and cognitive ability.

Mathematics anxiety may have its roots in a much larger, vague, and elusive construct of anxiety (McAuliffe and Trueblood, 1986). Math anxiety is linked to the affective domain of learning in various fashions. More specifically, attitudinal variables that account for the makeup of the level of math anxiety include beliefs, attitudes, values, interests, and emotions (Bessant, 1995). Math anxiety is often referred to as multidimensional because of the number of factors that are associated with it. McAuliffe and Trueblood (1986) also report that mathematics anxiety is moderately correlated with emotionality, worry, trait, and state anxiety.

CHAPTER THREE

Methodology

Introduction

The purpose of this study was to identify the extent to which math anxiety among Chippewa Valley Technical College students in Wisconsin exists.

Description of Subjects

Subjects selected for sampling were students taking electronics math courses at Chippewa Valley Technical College during the fall semester of 2002. All students were male, and the majority, 76% had an electrical power distribution major. The average age was 22.8 years with a standard deviation of 5.38 years. The students had an average self-reported grade point average of 3.264 with a standard deviation of 0.4474.

Selection of Sample

The survey was focused and limited to the main campus of CVTC, the Clairemont Campus. Survey respondents were in at least one math class at CVTC during the fall semester of 2002.

Instrumentation

The survey instrument used was the Mathematics Anxiety Rating Scale, (MARS), developed by Dr. Richard M. Suinn. The Mathematics Anxiety Rating Scale is a 98 item self rating scale which may be administered either individually or to groups. Each item on the scale represents a situation which may arouse anxiety within a subject. The subject is to decide on the degree of anxiety aroused, using the dimensions of “not at all”, “a little”, “a fair amount”, “much”, or “very much.” A five-point Likert scale was used to score the survey.

A test-retest reliability coefficient for the MARS was calculated from the scores of two complete classes ($n=35$) of students from a University of Missouri sample who were retested seven weeks later. The mean MARS score on the first testing was 235.08 ($SD=51.26$); the mean score for the second testing was 232.97 ($SD=56.46$). The test-retest reliability coefficient was 0.78 after two weeks, significant at $p<0.001$. This is comparable to reliabilities of other scales frequently used in clinical practice, e.g., 0.80 for the Taylor Manifest Anxiety Scale, 0.78 for the Test Anxiety Scale, 0.68 for the Social Avoidance and Distress scale, and 0.72 for the Fear Survey Schedule (Suinn, Edie, Nicoletti, Spinelli, 1973).

An internal consistency reliability coefficient shows that the average intercorrelation of the items in the test is quite high. It confirms that the test is highly reliable and indicates that the test items are heavily dominated by a single, homogeneous factor, presumably mathematics anxiety.

Data Collection Procedures

Data was collected during the class time of all survey respondents. Participants were informed that this was a voluntary survey and filling out the survey implied consent.

Data Analysis Procedures

Surveys were collected and manually scored by the researcher. The survey is designed so that a point value is associated with each of the five possible answers; one point for a response that involves the least amount of anxiety, all the way up to five for a response that involves the greatest amount of anxiety. Scores are then summed to give a total score between 98 and 490.

Mean scores for various aspects of the CVTC sample were reported, and in some cases, compared with other mean scores obtained using the same survey instrument.

Demographic information factors such as age, gender, major, completed credits, credits required for degree or diploma, expected grade, grade point average, and dislike of mathematics were collected and used in determining correlations where applicable.

Limitations of Method, Sample, and Procedures

Law requires that surveys done for research purposes are only to be completed voluntarily. Because of this, we have a statistical limitation known as voluntary response bias. Voluntary response surveys are more prone to statistical bias. The disadvantage is that this method is likely to include more of the individuals with strong opinions, especially negative opinions about the issue in the sample, so it tends to be biased. Conversely, an advantage of voluntary response sampling is that the subjects are more likely to be knowledgeable about the issue being investigated.

A limitation of the sample includes a relatively small sample size, which made it difficult to obtain significant results. Also, the sample was fairly homogeneous; all were males of relatively the same age and most had the same major. The sample was most likely not representative of the student population at CVTC.

CHAPTER FOUR

Data Results, Analysis, and Discussion

In order determine whether or not math anxiety was a problem, a brief instrument item-analysis showed that students rate high anxiety levels for questions related to algebra, word problems, and study-related questions. The mode response to these types of questions was “Much Anxiety,” the second highest anxiety level. Respondents rated low anxiety levels for questions relating to counting, observing, and other tasks that required low cognitive ability. Mode responses to these types of questions were at the lowest possible anxiety level.

The 25 respondents from two classes yielded a mean MARS score of 220.68 and a standard deviation of 74.48. An average of 220.68 over the 98-question survey meant an average Likert score of about 2.25. This average lies between a fair amount of math anxiety and much math anxiety. The 95% confidence interval for the population mean ranges from 189.94 to 251.42.

The CVTC sample was compared with the initial reliability test conducted on the instrumentation in Missouri, and the relative difference in means was found to be about 6.1%, which was not significantly higher. The Missouri reliability testing also had two complete classes (N=35), yielded a first test average of 235.08 (SD=51.26), and a second average of 232.97 (SD=56.46).

Percentile ranks for raw scores in the CVTC sample are shown in the following table, and are compared with the large Missouri sample (N=397) that had a mean of 215.38 (SD=65.29).

Table 3: Percentile Ranks for CVTC MARS Scores

Percentile	Score
5%	123
20%	165
40%	189
50%	215
60%	228
75%	225
80%	267
95%	325

Table 4: Percentile Ranks for Missouri sample

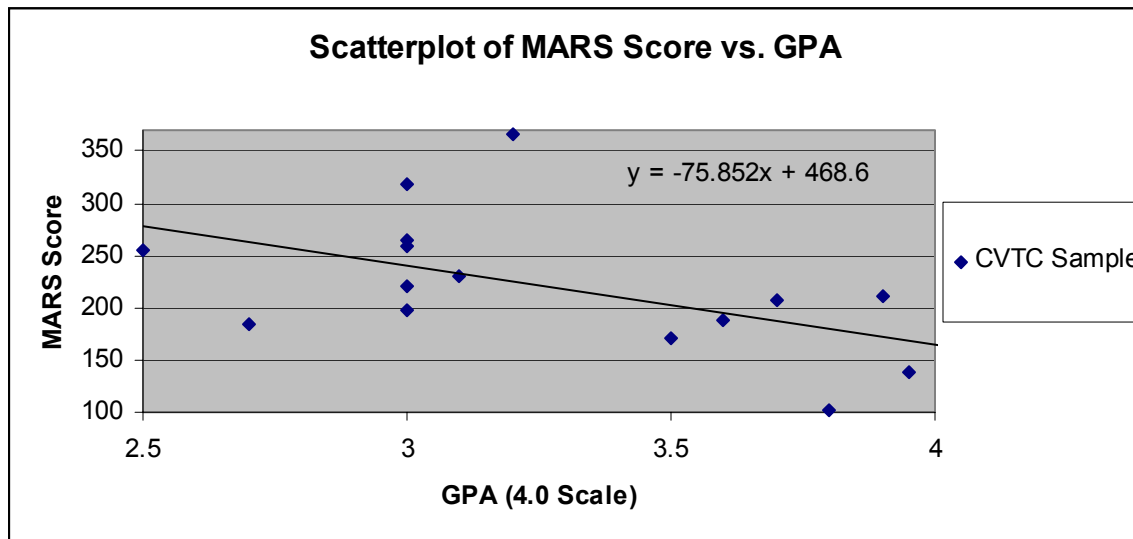
<u>Percentile</u>	<u>Score</u>
5%	99
20%	159
40%	198
50%	205
60%	220
70%	252
80%	258
95%	354

A mean comparison was done to the CVTC sample ($\text{mean}_1 = 220.68$) and the large Missouri sample ($\text{mean}_2 = 215.38$), and it was found that the CVTC sample mean was not significantly higher ($t = 0.303$).

A t-test was also done for the CVTC mean and the re-test reliability mean score for the MARS survey. While the CVTC mean was higher, significance cannot be claimed due to small sample sizes for both studies ($t=0.695$).

The MARS scores for the CVTC sample were correlated with two performance factors: grade point average and dislike of mathematics. Sixty percent of the respondents gave answers to their GPA, and 100 % gave answers to their dislike of mathematics. Their respective scatterplots are shown below.

Figure 3: Scatterplot of MARS Score vs. GPA

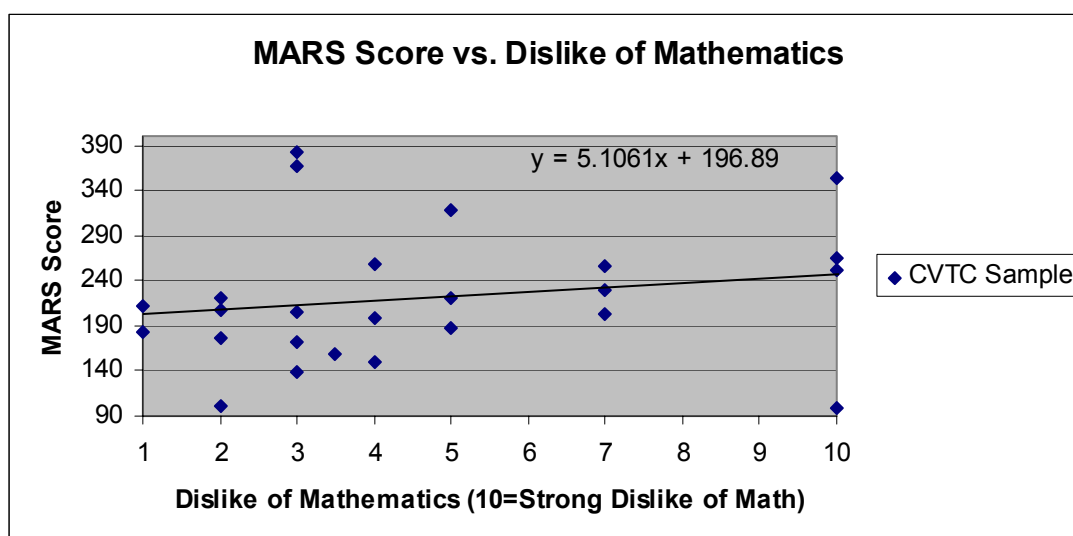


There is a moderate downward trend, as identified by the slope value of -75.852 on the linear regression line, and a correlation coefficient of -0.5092462 . This follows intuition in that the higher the academic performance (GPA), the less math anxiety.

The scatterplot appears to be divided into two distinct groupings; those with GPA's at 3.5 or above, and those below 3.5. The mean MARS score for the group with GPA's at 3.5 or above is 169.834 (SD=42.51). The mean MARS score for the group with GPA's below 3.5 is 255.22 (SD=57.98). Of course, we expect the general trend of the sample to be negative, but an analysis of the correlations for the two subgroups shows that the group with lower GPA's has a positive relationship ($r=0.414$), which contradicts intuition. This may be due to a small sample number and/or outliers.

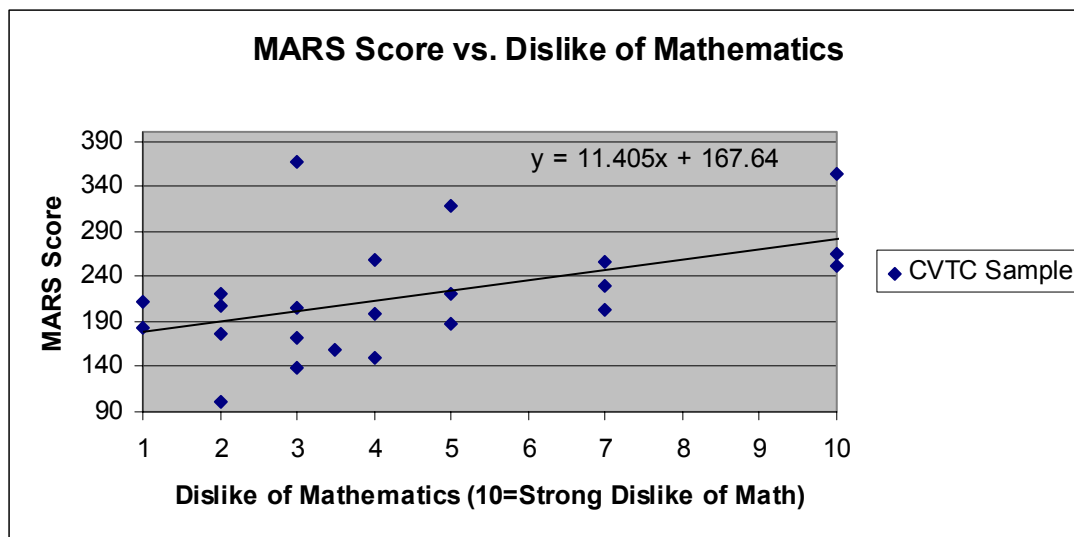
Since 40% of the respondents did not provide GPA information, it was worthwhile to examine the MARS scores of those who responded and compare it to those who did not. Persons who do not provide such information either do not know it, or may not wish to disclose it for whatever reason. It was found that the mean MARS scores for those who did not respond to the GPA question had almost the same mean MARS score for those who did. The two respective means are 221.067 (SD=66.64) and 220.1 (SD=88.78), a relative difference of about 0.44%, and are not significantly different.

Figure 4: Scatterplot of MARS Score vs. Dislike of Mathematics



Here, there is a slight upward trend as identified by the positive slope value of 5.1061 for the linear regression line, and a correlation coefficient of 0.199. There are, however, two points that if considered outliers, make the regression line and correlation coefficient a better fit. Omitting the points (10, 99) and (3, 382), we get the following graph:

Figure 5: MARS Score vs. Dislike of Mathematics



The Pearson correlation is now 0.49, and the regression line has a steeper slope of 11.405. This data also supports intuition in that the more a student dislikes math, the more math anxiety he or she experiences.

Other Discussions of the Data

All respondents of the CVTC sample were male, and 76% reported having identical majors in Electrical Power Distribution. Both classes from which the sample was taken were electrical math class. This is a highly male-dominated major, and is a reason for the skewed sample. The ages ranged from 18 to 38, and averaged 22.79 years

with a standard deviation of 5.38 years. It should be noted here that the lack of variety in demographics limits the extrapolation to the whole student population at CVTC.

A Pearson coefficient was calculated for age and MARS score. A positive correlation of 0.1282 was found. The fact that it is positive means an increase in age yields an increase in math anxiety, generally speaking. The degree for which this is true is reflected in the value of the correlation. So while some evidence to support the idea that an increase in age yields an increase in math anxiety, the evidence is not very strong.

A Pearson coefficient was also calculated for expected grade (converted to grade points) and MARS score. A small, negative correlation of -0.0883 was found. This means the higher the expectancy in grade, the lower the level of math anxiety. The fact that this value is very close to zero means the relationship is weak. This may be due to an over-confidence in the respondents' grade expectations for the class.

CHAPTER FIVE

Summary, Conclusions, and Recommendations

Restatement of the Problem

Math anxiety is a problem. It can affect peoples' everyday life, students' academic careers, and even contribute to stress, which is well known to cause many other problems.

Methods and Procedures

The Mathematics Anxiety Ratings Scale was administered in math classes at Chippewa Valley Technical College and used to determine the level of math anxiety each respondent typically experienced. Scores were recorded and measured against other data to find and determine correlations, means, and other statistics.

Major Findings

It was found that the mean anxiety levels and standard deviations recorded at CVTC were comparable to those done in other studies, in other states, in differing time periods that used the same survey instrument. Scores were compared to performance variables such as grade point average and dislike of mathematics. It was found that GPA correlated negatively with math anxiety levels ($r = -0.5093$), and a dislike of mathematics correlated positively with anxiety levels ($r = 0.199$).

How much math anxiety exists in math students at CVTC is evidenced by raw MARS scores, and comparisons to norms in similar situations. Because the mean CVTC MARS score was not found to be significantly higher than other means, it cannot be concluded that math anxiety exists in high levels at CVTC. The mean scores alone cannot determine whether or not math anxiety is a problem for the student or the school. This is evidenced by the various types of questions in the MARS survey, and the varying

responses to them. In order to determine problem areas for students, more specific questions must be asked. For example, if trying to answer whether or not math anxiety is a problem for the student body, one must determine which aspects of math anxiety pertain to a declared problem within it. If high anxiety levels in algebra, word problems, and study habits are criteria for problematic situations in a student or student body, then the results of the study suggest that math anxiety is a problem. If high levels of anxiety in counting, observing, and other low-cognition types of questions are criteria for problems within a student or student body, then math anxiety is not a problem at CVTC. A full-scale item analysis of the Mathematics Anxiety Ratings Scale, and administrative determination of problem areas for students and student bodies are required to specifically determine whether or not math anxiety is a problem for students at CVTC.

The relationship between school performance and math anxiety is evidenced by the correlations between grade point average and anxiety levels, and dislike of mathematics and anxiety levels. It was found that a negative correlation ($r=-0.509$) exists between GPA and anxiety levels. Thus this study shows evidence that students with low anxiety may perform better at CVTC. It was also found that a positive, but slightly weaker, correlation ($r=0.49$ excluding outliers) exists between dislike of mathematics and anxiety levels.

The main demographic factor that was found to correlate with math anxiety is age. A positive, but weak, correlation of 0.1282 explains our sample's relationship between age and math anxiety levels.

Recommendations Related to This Study

1. This study was completed in less than five months; more overall time devoted to this study is a good recommendation.

2. Sample selections are recommended to be more representative of the larger population.

Recommendations for Further Study

1. Further studies should aim to have larger sample sizes.
2. Further studies should aim to have more representative sample respondents from the population.
3. A deeper investigation into the uses and application of the Mathematics Anxiety Ratings Scale in prior research should be conducted, and applied or integrated into a more thorough literature review.
4. Although subjects took a relatively short amount of time to fill out the survey instrument, it is a possibility for future studies to have a condensed version of the Mathematics Anxiety Ratings Scale. It is documented that other similar studies have done just that, and reduced data collection time.
5. Expand on the number of demographic variables collected for more computational possibilities.
6. Ask for permission from institution to obtain actual data such as GPA, rather than rely on the memory of the respondents. This also helps with reliability and minimizes the number of non-responses.

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APPENDIX A

Math Anxiety Survey Results

<u>Math Anxiety Survey Results</u>			
<u>Variable</u>	<u>Average</u>	<u>Standard Deviation</u>	
Age	22.791667	5.3809581	
Completed Credits	17.70454545	24.56839206	
Credits Required	33.63157895	7.304568786	
GPA (4.0 Scale)	3.26333	0.4474	
Expected Grade (4.0 Scale)	3.2431666	0.78627701	
Dislike of Mathematics	4.66	2.903733229	
MARS Score	220.68	74.47467131	
MARS Score, Responded to GPA	221.06666	220.1	66.6402566
MARS Score, No Response to GPA	220.1	88.7794	
Pearson Coefficient for	<u>r</u>	<u>r^2</u>	<u>Slopes of Regression Lines</u>
GPA & MARS Score:	-0.5092462	0.259331692	-75.852
Pearson Coefficient for			
Expected Points & MARS Score:	-0.0882644	0.007790604	
Pearson Coefficient for			
Dislike of Math & MARS Score:	0.1990863	0.039635355	5.1061
Pearson Coefficient for			
Age & MARS Score:	0.1281747	0.016428754	
t-statistic for CVTC & Large Missouri Sample:		0.302928639	
t-statistic for CVTC & Re-test Reliability Scores:		0.694741669	