Math Anxiety Interventions

Mary Jane Klips
The College at Brockport

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Math Anxiety Interventions

by

Mary Jane Klips

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Math Anxiety Interventions

by

Mary Jane Klips

Approved by:

[Signatures]

Advisor

Date

Director, Graduate Programs

Date
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A. Introduction

Math anxiety has many definitions, all of which describe fear, panic, increased heart rate and the inability to perform when necessary. The end result is low self-esteem and lack of confidence which further debilitates the learner. This statement is based on my own experience in mathematics throughout my public school career as well as observations and discussions with students and is supported by researchers, Stuart (2000) and Shields (2005).

Marilyn Burns (1998), a leading researcher in mathematics education contends that two thirds of the adult American population detest and fear mathematics. So what are the reasons for this epidemic from which millions of Americans suffer?

One researcher and fifth-grade teacher, Vanessa Stuart (2002), compares succeeding at mathematics to excelling at any sport, “It is ninety percent mental and ten percent competence” (p. 2). If this information is to be accepted, than what can be done to heal and prevent our students from developing math anxiety and failing to succeed because of it?

There is a wildly accepted opinion that males tend to suffer from a fear of math less often than their female counterparts, which has resulted in the false belief that they are inherently more mathematically capable,
reports Tobias, a leading researcher in the area of math anxiety (1993). Researchers, Tapia and Marsh (2004) found that this is not the case. In fact, girls and boys are equally capable of learning and mastering mathematical skills which are required by today's educational system. These researchers further report that the discrepancies we see, which may lead us to believe this, are in fact due to many factors which are not related to biological differences. These factors will be discussed in the following chapter.

Personal experiences in the school setting are more likely to be responsible for the performance anxiety which both males and females seem to suffer in the area of mathematics states Shields (2005). Shields further notes that most students can name the teacher who first perpetuated their fear. Researchers Jackson & Leffingwell (1999) believe that behaviors exhibited by teachers themselves may have a great impact in the development of math anxiety in students. Educators who are hostile, exhibit gender bias, fear mathematics themselves, are uncaring and express anger as well as frustration with students, are often responsible for the onset of this condition. Suggestions for rectifying these situations will be discussed in a future chapter.

Conditions which are often beyond the teacher’s control, within the school setting, can also create and promote math anxiety. These can be communication and language barriers, the method of assessments
required by the state and the weight they carry for districts, as well as the
difficulty of the material covered at any given grade level, state Furner
and Duffy (2002).

According to Cordes, attitudes which students bring to school
about mathematics can also influence their beliefs and ability to
succeed. Negative predispositions can come from parents who
themselves have experienced poor math performance. Often, they tell
their children that they did not understand math when they were in
school, so the child must have inherited their inability. This seems to give
the child reason not to try and parents acceptable expectations for low
achievement (2003). Students who come from low socio-economic
backgrounds may feel they are incapable of mastering mathematics
because the family has not had the education or exposure to this subject
which would promote positive feelings (Furner and Berman 2003).

B. Statement of the problem

The primary problem I encountered when working with students in
the area of mathematics, was their inability to perform successfully on
assessments. These students were, however, able to exhibit understanding
in their class work and homework. Their failure to reach academic
benchmarks required by my district and the state assessments prevented
them from excelling in math, which further reduced their confidence.
Other students have been unsuccessful at math prior to entering my class. They stated that in the past, they did try to do well in class and completed homework, with negative results. These learners decided they were unable to prevail in this subject and consequently give up.

Due to their unsuccessful performance, these students have then been targeted for Academic Intervention Services (AIS). It has been my experience that students placed in AIS have a negative image of why they are placed into this program and label themselves as "stupid." As expected, their self image and confidence level are further reduced.

My goal was to provide learners with research based interventions which helped to alleviate math anxiety, support academic success and rebuild self-confidence.

Students who fear mathematics, for any reason, are not succeeding at reaching the benchmarks set forth by state educational systems and are not enrolling in higher level mathematics courses in high school as an avoidance mechanism states Ashcraft and Kirk (2001). Therefore, young adults are not leaving high school with the mathematical education required to succeed in higher education endeavors or to perform within the workplace setting without remediation. I believe that in many cases, with the assistance of educators who are informed regarding the causes of math anxiety and who put into place
the recommendations offered by researchers, students can become confident with their ability in mathematics and find success.

C. Significance of the problem

Understanding and mastering mathematics is necessary for students to graduate from high school and, for those who choose to continue their education. It is also critical in securing and retaining employment in the field of their choice.

Why is sound knowledge of higher level mathematics upon graduation necessary? In an article in *HR Magazine*, Kathryn Tyler (2003) reports that corporate leaders want employees who can interpret cost-benefit analyses, to better understand how spending decisions impact the company’s profitability.

According to Tyler, "Pencil pushers aren't the only employees who need math anymore. Math is as common in the factory as it is in the office." (p. 2). Employers also report they are dealing with math anxiety on the job site. When promoting workers from blue collar jobs to management positions, Tyler reports employers have found that many of these people lack the necessary skills to perform their new jobs, and the employee is often terrified at the prospect of learning the math required (2003).

Line workers and product packers are required to compute defects in parts per million and calculate how many parts will fit into a packing
box. Failure on the worker's part to have the necessary math skills can result in a loss of profit for companies and ultimately jobs. Employers are faced, reports Tyler (2003), with providing math skills courses to bring their employees to the level of understanding required for the job.

If students who feared math to the point of shunning it were assisted with their difficulties while in the education system, schools would graduate individuals who are better prepared for the work force and eliminate years of destruction to their self-esteem. "During my tenure in teaching students who are struggling in this subject area, I have found many have already given in to their negative beliefs or are so fearful they continue to not reach mastery.

The purpose of this research project was to help students reclaim confidence and make gradual academic progress in the subject of mathematics by working in a safe, comfortable learning environment where participants were supportive of each other and fears were met with understanding and backed by sound research.

D. Rationale

In a paper written by Richard Riley, United States Secretary of Education (1997), he states that mastering mathematics has become more important today than ever before in history. Having a strong grasp of math opens doors in education as well as in the job market. He suggests that eighth grade can be an important turning point in a
student's math future, which can lead to participation in higher level courses in high school and result in greater choices when it comes to future career opportunities. He reports that middle school may be where the weak link lies. I disagree with this statement. As an upper elementary teacher, many of my students have reached fifth grade with high levels of anxiety for math and lack of confidence already in place.

Jackson and Leffingwell (1999) report that many students faced their first traumatic experience with math in the third or fourth grade as this is where higher expectation for understanding begins with the introduction of multiplication and division.

As middle school students struggle with more demanding math concepts, they believed that their lack of success was due to their own inability with the subject and that increased effort rarely resulted in success (Shields 2005). Consequently, they gave up. It is my belief that the real problem stems from their failure to reach educational benchmarks while in the lower elementary grades. The basic concepts, normally learned in lower grades, have eluded these students and have resulted in limited understanding of math theories. This lack of mastery prevents students from having a solid foundation for mathematics as they progress through the educational system. This continued lack of academic success creates the personal belief within students that they are incapable of mastering any mathematical concept.
It is imperative that students who suffer from any level of math anxiety be provided with research based interventions by knowledgeable teachers. In this study, I used proven techniques to assist my students in overcoming their fear of math and help them to build self-confidence which resulted in higher math grades.

Current research based interventions used in this study included teacher suggestions on promoting a positive attitude and classroom, providing positive work-related feedback to students and offering learning experiences which assisted students in dealing with math anxiety in an academic setting. I initiated these strategies and utilized them on a regular basis, and my students grew in the area of self-confidence and their below average math scores improved.

E. Method

Students from my two sections of grade five mathematics classes were given The Math Survey developed by Stuart (2000). The survey assessed their feelings in the area of math, how they felt when asked to perform math tasks and to share what was their best and worst experience in math. This survey also asked how parents and/or guardians felt about mathematics. The purpose of this question was that often time’s some parents vocalize their own lack of understanding of this topic when they were students and assume their child has inherited their inability, thus giving the student an acceptable reason not to succeed.
also observed all students and assessed which learners appeared to be exhibiting with some level of math anxiety. The behaviors I looked for were underachievement, avoidance of the subject, failure to complete homework or class work as well as unwillingness to participate in classroom activities. Personal interviews were held with each student who indicated negative feelings toward math and was failing to meet the state mandated benchmarks. The accumulation of this information was used to identify students needing intervention services.

Once the research group was identified, small group instruction was provided during the regular school day which included the interventions suggested by researchers such as the journaling of feelings during the work process, positive feedback from the teacher and methods used to relieve stress.

In the course of researching this topic, several references have been made to the importance of connecting current learning to the value of mathematics in the real world. Therefore, I created a questionnaire students had completed by two adults that showed how math impacted their duties both at home and at their place of employment. This generated discussions within the classroom how mathematics is a part of everyday life and that all people need to be committed to learning it.
In a study conducted by Ridlon (2004), students were required to write in a journal frequently. She found that this activity helped her students adopt the belief that expressing their feelings and ideas in writing was an important component in the process of learning mathematics. Adopting this tool, I created a “Think and Feel” sheet which provided journaling opportunities for each student. This sheet was attached to their work packet so they could express their feelings as they worked, as suggested by Furner and Duffy (2002). Students' final comment was to provide a “Positive Statement,” on their work in class for that day.

Participants also used a "Stress-O-Meter" which I developed to indicate their stress level during independent work. The tool is a number line, from 0-10, and indicates how stressful a student is feeling during the work process. The advantage of using this is that it provided quick feedback for me to see instantly who needed support as well as visually indicating to the students that they are feeling stress and should use the methods provided to deal with it.

A list of things students should consider while working which Furner and Duffy (2002) suggest helps to reduce student stress, was posted in the classroom and students were encouraged to refer to it regularly.

At the end of one month, students were to complete The Math Survey, (2000) again as well as one final "Think and Feel" chart to appraise
their level of comfort and determine if there had been a positive change due to the interventions.

I charted the Stress-O-Meter results over the course of one month to determine if any change in stress levels had occurred. I also provided a graph on each student, to assess academic growth over the course of the study.

F. Definition of Terms

1. **Math anxiety:** the intrinsic fear one experiences when faced with mathematical operations, causing elevated stress levels which interfere with the brain’s ability to perform.

2. **Academic Intervention Services (AIS):** services offered within the school setting that assist students in meeting state mandated benchmarks.
Math anxiety, Furner and Berman believe is the result of frequent experiences in the mathematics classroom which have been negative. It is not a mystery that people who fear something, do not perform well when confronted with it. When a student has continually underperformed and felt unsuccessful in working with mathematics, they are filled with uncertainty and suffer from a lack of confidence. Even students who are normally successful in day to day classroom instruction, can fail to succeed when faced with an assessment if they feel high levels of anxiety (2003). With this anxiety or tension, understanding and recall pathways become cluttered by emotions which result in the inability to think and short term memory is severely affected, states researcher Steenhuysen (2007).

In 2001, researchers Ashcraft and Kirk reported their belief about what happens when a student experiences anxiety in mathematics. These researchers have suggested that when a student has been asked to perform, their anxiety with the situation over takes the working memory part of the brain normally used for skill performance and interferes with the actual problem solving process. Therefore, the student is preoccupied with doubt about his or her ability and is unable to focus on the task at
hand. The student's focus becomes talk of self-doubt rather than computing problems.

Math anxiety affects not only underachieving learners, states Beilock and Carr, (2005). "At some time in their career, most teachers have seen even their brightest students choke under pressure," (p.1). High achieving students generally rush through an assessment making careless errors such as carrying, borrowing and dividing inaccurately. In this study the researchers looked at students who had low working memory (LWM) and those with high working memory (HWM) to evaluate how stress affected their performance. The results were the same states Beilock and Carr, (2005). In high stakes situations, the pressure students put on themselves to perform overtakes their working memory. Negative self-thoughts consume working memory and results in the inability to retrieve material necessary for academic success.

In April of 2006, President George W. Bush instructed the Department of Education to delve into what factors were responsible for high schools across the country graduating students who were not proficient in mathematics. The United States, once a leader in mathematics globally, found only 7 percent of fourth and eight grade students reached the advanced level on the 2003 exam reports the National Mathematics Advisory Panel (NMAP) (2007).
Researcher, Cavangh (2007) proclaims that the only way to remedy the problem of underachieving students in math is to better understand the causes and implications. He believes that although students can have anxiety for any subject, it is most often observed in math because it involves numerous concepts and procedures which are alien and abstract.

The NMAP found one of the factors for the decline in U.S. mathematics scores is due to the inadequate preparation given to pre-service teachers who are in the classrooms, especially at the elementary level. Institutions of higher education have evaluated and adapted their methods programs to better prepare future teachers for the classroom. It is further recommended that once in the classroom, teachers be provided with in-service opportunities which continue to equip professionals for student success (2007).

Marzano’s (1992) ground breaking development of The Dimensions of Learning Models is based on the understanding that learners must have positive attitudes and perceptions towards learning before real learning can occur. If students enter the classroom with negative predispositions for math and believing they cannot succeed, the teacher must be well prepared to provide interventions to alleviate the problem.

Researchers have discovered that many of the students, who faced traumatic experiences in math, first did so in the third or fourth grade as
this is where more abstract math and high expectation assessments began (Jackson & Leffingwell, 1999). These researchers further reported that some teachers at these levels were responsible for displaying hostile attitudes and making derogatory comments when students did not grasp concepts, asked for additional assistance, or showed uncaring attitudes. Middle school students echoed this information, including ridiculing behavior by teachers in front of their peers as a contributing factor of anxiety.

Teachers who exhibit unprofessional behavior may do so because of their own feeling of inadequacy in math. If they have not faced their own anxiety over the subject and have not been properly instructed during their methods courses, Furner and Berman believe their personal angst can be detected by their students and create anxiety (2003). These researchers further believe in the importance of in-service opportunities which can assist teachers in meeting the needs of students. They feel the time and money spent for in-service opportunities which teach new research-based practices for mathematics instruction will help teachers feel more confident in the classroom and will result in greater achievement on behalf of the students.

In an article regarding in-service programs that made a difference in student and teacher performance, Daane (2001) reported that the best in-service opportunities are those that the teachers themselves request.
Teachers, she reports, want to be provided with hands-on activities which they can take back to their classrooms and implement. She suggests districts hire professors from area institutions of higher learning who specialize in mathematics instruction at any given level. They can often provide teachers with the latest strategies, tools and research.

Teachers, suggests Schwartz (2000), need to put themselves in their student's shoes and recall how intimidating learning new math concepts can be. He urges educators not to fall back on the way they were taught math many years ago, but rather to abide by current research and use methods which teach critical thinking skills.

The culture of the math classroom, reports Furner and Berman (2003), can be a source of concern when looking at anxiety within students. Classrooms which are considered rigid and structured often encourage trauma for students as teachers want students to simply search for the right answer rather than develop a deeper understanding of math concepts.

The National Council on Teaching Mathematics (2007) further contends that the environment of the classroom is as important as the teacher. The culture of the setting can help students to develop a strong, positive attitude for the subject of mathematics.

Discovery learning classrooms are preferred for all students,
especially those with performance fears. They offer group learning and conversations which assist students in building meaning and understanding as well as the security to ask questions and propose ideas without backlash from teachers or peers, Furner and Duffy believe (2002). Teachers need to be mindful of how they react to incorrect classroom responses offered by students, states Curtain-Phillips (2007), as they can set the tone for classroom participation and do further damage to a student’s self-esteem if handled negatively.

Researcher Farrell (2006) reminds teachers that students who are not succeeding in math most often are afraid to ask questions regarding prior learning because they do not want to appear foolish in front of their peers. She adds that if students are unable to verbalize their learning, they probably are unable to apply it when working independently; therefore oral assessments are an important tool for teachers.

Scheduling private conferences with students to discuss their weaknesses and strengths helps students and teachers to develop a plan for reaching goals. This type of interaction, believes Stuart (2000), has the potential to create a strong bond between the student and teacher, as well as inciting the student’s desire to learn.

Furner and Duffy (2002) suggest students use reflection journaling to review problem-solving strategies and allow students to reveal their true feelings about learning. Stuart (2000) agrees with journaling as she found
in her study that it can lead to increased confidence in mathematics.

Providing this tool allows students to vent frustrations faced during the learning process and allows teachers a window into the students' thought process to better plan for re-teaching experiences.

Teachers should include several measures in their lessons to assist all types of students with learning mathematics, according to Furner, Yahya and Duffy (2005). The use of real objects during instruction, such as coupons, food items and blocks help students to grasp concepts necessary for success. They insist on the scaffolding of new learning to prior knowledge, interlacing everyday problems and moving from concrete ideas to abstract when teaching. It is also recommended by these researchers that students be encouraged to use drawings to aid them in problem solving attempts, especially for the visual learners in the classroom.

A useful strategy for learning is for students to think-aloud when solving problems of all types. If they are working in a cooperative group situation, which is highly recommended, the other members can help with the steps of problem solving or internalize the steps better themselves through this exercise, state Furner and Duffy (2005). This working situation also provides the opportunity for learners to work using the necessary math vocabulary with their peers to reach greater understanding and automaticity in their meanings. Another advantage offered by working in
groups is that it provides struggling learners with peer role models and raises social support, states Ruffins (2007). For the English Language Learners, peer role models offer language development which has hampered their learning across the board (Furner, Yahya & Duffy 2005).

It is highly suggested that teachers integrate mathematics into lessons for other areas of study. An example of this is using measuring to read maps in social studies. This helps students to see the necessity for learning math skills for use in everyday life (Duffy & Furman, 2002).

The use of children's literature to teach math concepts can help students to learn topics is an enjoyable, visual and non-threatening way states Furner, Yahya and Duffy (2005). There are several trade books available to meet this need.

As stated earlier, there is a widespread belief that males are more successful at math than females. This belief has no roots in biology but rather in culture, states Sheila Tobias, a renowned researcher in the area of math anxiety and author of "Overcoming Math Anxiety" (1978). She believes that this is partly due to the fact that girls lack female role models in the areas of math and science and that math can be viewed as unfeminine. Her position is that males are encouraged from a young age to play with building blocks and to participate in sports which give them an advantage due to greater spatial development. She also believes
that boys are encouraged to take risks which girls are not, and they tend to persevere whereas females become defeated.

Tobias (1978) states that minorities can be at a disadvantage as well due to factors such as poor nutrition, unstable home environments and less qualified teachers.

In an article from Princeton-Brookings (2006), researchers reported that although malnutrition is rare in the United States, anemia and iron deficiencies are found and do pose serious health risks for developing children. These conditions may lead to attention deficits as well as poor academic performance. This paper cited a study where young children who were part of the Woman, Infants and Children (WIC) program which provides foods necessary to healthy development, were born with higher birth weights and consumed important nutrients, therefore exhibiting fewer cases of anemia. They also reported theses children showed higher scores in language tests. Good nutrition not only fuels the body for proper growth, it prevents diseases which can affect school attendance.

Students spend only a small portion of their time in the school setting and factors such as their home environment influence their academic progress writes Koppich (2006). Parents instill their own beliefs and values for education in their children long before they enter the academic arena. If education is valued in the home, students will often strive
to succeed. For the students who do not come from backgrounds where education is viewed as a necessary tool for a successful future, academic success is often meaningless.

Students who come from impoverished backgrounds are at a great disadvantage when they enter school. Often, reports Koppich (2006), they come from one parent homes. The parent is forced to balance work, home responsibilities, and raise children without a great deal of support. The lack nutritious foods and adequate health care, which these families face, can have negative effects on students' ability to be physically prepared for the learning they are expected to undertake while within the school setting.

Violence in the home and community, states Koppich (2006), can also be a factor which influences a student's success in an academic setting. Students, who come from homes where they are victims of violence or in neighborhoods where gang activity is rampant, may not believe that they have a future. With a focus on neighborhood survival and/or acceptance, students in these situations tend not to see the value in education and fail to meet state benchmarks for learning.

Finally, students who attend schools in economically disadvantage districts are met by less qualified and often less experienced teachers' as stated in a paper from the Center for Policy Alternatives (n.d.). This article reported that at schools where more than seventy-five percent of the
student body received free or reduced lunch, only twelve percent of the teachers were Nationally Board Certified. This report attributed these statistics to burn-out in high-risk schools, low teacher salaries, large class sizes and the lack of student discipline.

According to Tobias, (1987) a leader in math anxiety research, mathematics has gained a reputation for being a difficult, abstract subject where individuals are either successful or not. It has widely been viewed as a topic not for the average person but rather for bright students.

The methods teachers use to provide learning opportunities are important factors which can create or reduce anxiety for students. Teachers should limit the lecture type, repetitious board work format of teaching in the classroom. This is where notes and problems are written on the board and the teacher lectures and models the steps to solving mathematical problems (Farrell, 2006). Lecture type teaching does not ensure learning is taking place. When memorization methods are stressed rather than the understanding of concepts and reasoning as well as the linking of current learning to real-life experiences, states Farrell (2006), the concept is not stored in long term memory. This research closely aligns with the constructivist view of education which states students who interact with their environment and gain knowledge through hands on
learning experiences which are linked to prior knowledge, retain the
information at a greater level (Thanasoulas, 2001).

What can students do to assist themselves in reducing the stress
they feel when confronted with a math task? Researchers, Furner and
Duffy, compiled a list of steps for students to adopt which help diminish
their anxiety. This list should be provided to each student and posted in
the classroom and referred to as anxiety levels rise (2002).

The first step according to Furner and Duffy (2002) is for students to
overcome negative self-talk. As stated earlier, this can consume working
memory and prevent success. It also has the potential to become a self-
fulfilling prophecy. Second, students should be advised to ask questions
immediately when they fail to understand a concept which is being
taught. Since peer pressure may prevent some students from speaking
up, the teacher can institute a silent signal for students to use to alert her
to the need for further explanation such as students tugging on their ear.
This gives students an avenue to ask for help and keep their pride intact. If
students still do not understand what is being taught, they should speak
with the teacher on the same day that the concept is taught. Failure to
obtain help can result in the student falling further behind as the next
concept is introduced.

Third, Furner and Duffy (2002) believe students should consider math
a foreign language which must be practiced. Using the proper math
terms during learning and conversations helps students to become more comfortable with new terms as well as internalize the information.

Fourth, students should know that they cannot rely on memorization when learning mathematics. They need to understand the processes involved: this comes through practice and teachers asking questions which require critical thinking skills (Furner and Duffy, 2002).

Another way to reduce stress according to Furner and Duffy (2002), is for students to be physically comfortable while studying math. If a student needs to lie on the floor to complete independent work, they should be allowed to do so. Students should also be encouraged to take a break if their anxiety becomes too great. This can be done by taking a walk around the room, getting a drink or just stretching.

The use of calming techniques can help students to feel less anxious. Researchers Shobe, Brewin & Carmack (2005) suggest teachers use a short exercise of deep, slow breathing to reduce student stress. Having students close their eyes, relax their bodies and visualize a safe place can have positive results, especially on assessments. This is a life skill which students will be able to rely on without assistance after only a short time.

Finally, Furner & Duffy (2002) recommend students understand that they are responsible for their own successes and failures. They need to agree to be active learners by staying on task, asking questions,
participating in learning activities and completing homework. When underperforming they should admit that they did not ask for help or complete work and when success is achieved, they should celebrate their success. Students need to understand that they are in control of their learning.

In a study conducted by Ridlon (2004), sixth grade, low achieving mathematics students were divided into a control group and an experimental group. The mathematics material was mirrored for both groups; the difference was the methods of teaching, the environment and culture of the classroom.

The experimental groups' activities were primarily problem centered with few teacher directed activities. The teacher did not at any time instruct new learning and then ask students to practice the material. Student empowerment conversations were a regular occurrence between teacher and students as well as student to student.

Collaborative group work was the norm for the research group and included an atmosphere of respect and support between all members.

Journaling was used frequently during the course of the nine week study, fostering the belief that sharing feelings and ideas in writing was an important tool in the understanding of math concepts. Ridlon (2004) believes that journaling helps students to take responsibility for their own
learning as well as helping the teacher to gain insight into students
learning process and self-confidence problems.

This researcher reports her evidence suggests that the combination
of interventions within the experimental group may have assisted the
students in reaching higher levels of understanding which resulted in a
measurable increase in test scores. The students also self-reported they
were more interested in and enjoyed math more. They also felt greater
confidence and performed better than they had prior on assessments.

The above cited study, performed by Ridlon (2004), provides insight
to the workings of classrooms that strive for high levels of student success
achieved through the material presented.

While there is no current research that offers a steadfast “fix” to the
problems associated with the high levels of math anxiety felt by students
of varying ages, the research does offer practical solutions for today’s
teachers.

Being cognizant of the issue is but the first step in addressing math
anxiety. The true solutions will only be discovered through continued
dialogue between students and teachers, focusing on both the areas
where stress is most prevalent and reflection on successes as they occur.
Chapter III
Applications and Evaluation

Introduction

My short term goal of this action research project was to assist students who have a fear of mathematics to gain self-confidence in themselves and their abilities as well as to meet the benchmarks set forth by the state standards. The long term goal of this project was to prevent students from avoiding higher level mathematics classes in high school and college so they would have greater career choices available to them. The study looked at current research which identified the causes and provided interventions to assist learners in achieving mastery in mathematics.

Participants

The five, fifth grade students chosen to be participants in this study attended an elementary school in a rural district in Orleans County which services approximately 1,159 students with 52% of the student population in the building participating in the free/reduced lunch program. The elementary building houses grades Pre-K through fifth.

The participants were identified by scores received on a base-line math assessment administered during the first week of school, past Academic Intervention Services (AIS) involvement, and information gleaned from their permanent record as to past math performance.
The participants were also chosen based on observations made during regular classroom instruction and participation with the teacher, as well as through the use of private conferences with each student as indicated by the information they provided on the Math Questionnaire (see Appendix A). The five students chosen indicated they experienced some level of math anxiety which they felt had contributed to their lack of academic success in this subject area.

The study participants all were determined to be eligible for the free breakfast and lunch program. Two of the five were non-native English speakers who also did not meet the state benchmark for English Language Arts. Of the remaining three participants, one was black and two were Caucasian. Three of the students were female and two were male. None of the students were identified as needing special education services; however, one was targeted to attend the AIS math program for the current school year.

Five additional students were selected at random from the same grade level at the same elementary school by their respective math teachers. While these students received instruction in a different setting and manner, they completed the same questionnaires and surveys as did the study participants. Results from these students were evaluated and provided a control group by which the findings of this particular study could be compared and contrasted.
Procedures

All 38 students in the two sections of fifth grade math who were enrolled in the classes were given a copy of the Math Questionnaire and the Adult Math Survey (see Appendix B). The Math Questionnaire was used to assess students' attitudes and experiences regarding math and the likelihood of math anxiety being a factor in their math performance.

Their first homework assignment was to have the Adult Math Survey completed by two adults and returned for a class discussion. The purpose of the survey was to reveal to students the value of math skills which adults rely on at their places of employment, as well as in the running of their households.

The participants were provided with a "Think and Feel" (see Appendix C) form as well as the "Stress-O-Meter" (see Appendix D) chart to be completed during cooperative group or independent work times. The purpose of these tools was to provide an avenue for students to express how they felt during the work process and what they were thinking. These tools were also provided for students to recognize their use of negative self-talk and the need for finding positive moments during the work process.

The entire class was advised of and practiced stress relieving techniques to be used when they felt stress levels rise during instruction, class work or assessments. A poster displaying 10 Ways to Reduce Stress
(see Appendix E) was posted in a prominent place at the front of the classroom for easy reference.

Along with classroom instruction five times per week, participants were provided with small group instruction to complete homework assignments with the teacher during study hall. Another opportunity to work with the students was provided during block time. Block time is worked into all teachers' schedules, one period per week, for forty minutes of small group instruction with students who are struggling in any academic area. The participants for this study were included in this weekly learning opportunity. The focus of learning during this time was usually the re-teaching of skills they had failed to master as indicated by homework, observations or assessments.

At least one time per week, each participant was scheduled to meet with the teacher to discuss their learning, responsibilities, stress levels and weekly goals. Students' grades were also discussed. Noted improvements were used as a tool for motivation as students' successes, regardless of amount were celebrated. When no academic growth was reached, responsibilities held by both the teacher and student were discussed, such as the regularity of completed homework or additional help being provided and a new strategic plan was developed. For example, students not attaining success in the math classroom may have additional times, prior to or after school, to meet for extra assistance, or be.
provided with smaller homework assignments on a more consistent basis. This would be combined with greater availability of the teacher providing feedback. These conferences provided the opportunity for the teacher and the student to become learning partners and ensure that both were working towards the same goal.

The learning environment was discussed during the first days of the new school year in the experimental classroom. The students, as well as the teacher, were to be viewed as a cohesive family unit where respect, responsibility and support were part of every school day. The teacher's job was to teach students what they needed to know by the end of the school year and provide the support and learning opportunities toward this end. The students' responsibilities were to be active learners, complete tasks asked of them and never prevent learning for others by exhibiting disruptive behavior. Students were encouraged to assist others when they saw someone struggling with learning by moving next to them and offering assistance.

A classroom constitution (see Appendix F) was created by all members indicating behaviors which would be expected and those which would not be tolerated, along with a list of consequences. When anyone found any amount of success, it was celebrated by the entire class with a round of applause.
Humor and the enjoyment of learning was a daily staple in the classroom modeled by the teacher. When the teacher made a mistake or incorrectly stated something, students felt free to call her attention to it in a respectful manner, understanding that everyone makes mistakes.

All students were instructed to inform the teacher immediately when they did not grasp the skill being taught either by raising their hand or by tugging on their ear lobe to gain her attention if they did not feel they could verbalize their lack of understanding. The teacher frequently asked students to indicate their understanding by giving her a thumbs up, if they felt confident with the material, thumbs to the side if they were unsure or thumbs down signal if they felt completely overwhelmed during the course of all instruction as a visual means of assessing learning. When any student indicated a need for further instruction, either a peer would move to work one on one with that student, they would be placed into a cooperative work group with students who had shown understanding of the material or the teacher would work one on one with the student.

Regularly the students would be invited to study hall or block time. The responsibility for attending a study hall or block time was left up to them, which provided one way to show they were in control of their own learning.

The teacher, shared what math instruction was like for her in her own public school experience. A noted difference in the instruction
received by the participants in this study with those of the control group, was the teacher's openness with her own previous struggles and negative feelings toward mathematics. She further shared personal experiences which left her feeling unable to succeed in math and how she eventually overcame her dislike of the subject. She shared that being called to perform at the board in front of the class was terrifying for her as she felt as if she was being singled out for her lack of understanding. She explained that this would never happen in their classroom and encouraged students to share experiences which had made them feel uncomfortable in the past. It was further explained that she had taken control of her learning and spoke with teachers immediately when she did not understand information presented asking for assistance but not until adulthood. She urged them not to make the same mistake she had made.

Open conversations such as those stated above, were the foundation on which students built a level of trust, and the willingness to share frank, but honest feelings about their own experiences throughout the course of this study.

The students were informed that they, too, were responsible for learning math and they were praised when they asked for help. It was also indicated that failing to complete required work or not participating in learning opportunities would constitute a private conference with the student and may require parent contact.
**Instruments of study**

The most important elements of this study, which most profoundly affected the students involved, were the attitude and the behavior of the teacher combined with the classroom climate; all of which were discussed in the preceding section.

Another important facet of this study which gleaned positive results were the personal conferences held with each student. The attitudes of the students toward math after interventions were assessed through the continued use of the Stress-O-Meter and the Think and Feel worksheets. Information taken from these instruments provided diagnostic information to the teacher, in deciding whether to move to smaller group or cooperative group learning situations, or to utilize more independent work time.

The Stress-O-Meter was a tool created to monitor student stress during the work process. It consisted of a number line ranging from 0 to 10 on which students rated their level of stress, '0' being no stress to a level '10' which indicated the student felt completely stressed with the assignment. Each worksheet provided two stress lines; one to be completed prior to the beginning of class or homework assignment, and another to be completed after the task was completed. The purpose of the tool was to ascertain if after the task was completed, did the student feel his/her stress level was diminished or reduced. These worksheets were
retained by the teacher and reviewed to assess whether a student’s stress had declined over the course of the study. They also indicated if self-confidence has risen, by student accounts, which reflected less negative comments on the Think and Feel chart. This reporting mechanism was also discussed with students during weekly conferences and oral reflections to make the students aware of the changes which had or had not taken place.

The Think and Feel Chart was created to provide students with a forum to state how they were feeling and what they were thinking during the work process. It documented for the teacher and student, the use of negative self-talk, what exactly was being said and what positive aspect came from the work once it was completed. This chart also provided the teacher with instant notification if a student was struggling as she navigated the room during the independent or group work process.

This worksheet was referred to during private conferences with each student to alert them if they did speak negatively to themselves when working on mathematics and how these thoughts could have overshadowed their thought process.

Student assessments, which were teacher scored, were monitored to see if academic growth had taken place along with changes in stress levels.
At the end of the study, students were asked to complete a new copy of the Math Questionnaire to evaluate their attitudes and feelings and to indicate if changes had occurred due to the interventions.
Chapter IV

Results

Students involved in the Math Anxiety Interventions study were administered a pre-assessment on September 7, 2007, based on mastered knowledge of grade 4 math in the New York State Mathematic Curriculum. The assessment, Discovery Education ThinkLink Assessment Test A for grade 5 (Discovery Education Inc., 2007), contained 39 multiple choice questions. Grading was based on a four point rubric. A score of 4 indicated students had performed above grade level while a score of 3 showed students had met the benchmark. Scores of 1 or 2 were indicators that students were not reaching mastery for their grade level.

Students labeled A-E identify the experimental group, while those labeled with a prefix of C, are members of the control group.

The results for the pre-assessment scores of all members are found in Table 1 and 2.
According to Table 1, none of the students in the experimental group attained a benchmark of score level 3. Student E reached 2.8 out of 4, or 70%. Student B earned a score of 2.5, or 62.5%. Student D obtained a score of 2.4, or 60%, student A earned a 2.3, or 57.5% and student C scored a level 2, or 50%.
Table 2 shows the scores earned by the students in the control group on the same pre-assessment. The highest score was earned by student CB, with a score of 3.3 on the 1-4 rubric scale, or 82.5%. Two students, CA and CD, reached 2.5 or 62.5%. A score of 2.4 or 60% was reached by student CE and student CC earned a 2.3 or 57.5%.

The results from Table 1 and 2 showed the mean to be 2.4 for the experimental group and 2.6 for the control group. These statistics indicate that the two groups are similar in mean score, showing only a difference in overall mean of .2.
Other measurable results can be observed from the student self-reported responses on the Think and Feel Chart, which is similar to a student attitude survey. The purpose of using this tool was for students to journal what they were thinking and how they were feeling during independent work. Students were instructed to indicate if they were experiencing negative or positive self-talk while working and if they were feeling stress due to performing the task required. This information can be found in tables 3 and 4.

**Think and Feel Chart Responses**

**Experimental Group**

Table 3

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>THINK</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>FEEL</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>POSITIVE STATEMENT</td>
<td>-</td>
<td>+</td>
<td>x</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

The results of student responses over the five week study period indicated that due to the interventions, more positive comments and
statements were found. The increase of positive statement was visible after week three of the study.

In looking at positive statements made by students in the experimental group, student B indicated 80% of the time positive responses; such as "I can do Least Common Multiples, (LCM), better," beginning week three. Student A reported three weeks of negative comments in the beginning of the study and then cited positive reports in the final weeks such as I feel... "A little more confident and I like it" and "its fun and I understand it more." Over all, this group reported 36 positive comments out of a possible seventy five responses, or 49%.

Think and Feel Chart Responses
Control Group

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>CA</th>
<th>CB</th>
<th>CC</th>
<th>CD</th>
<th>CE</th>
</tr>
</thead>
<tbody>
<tr>
<td>THINK</td>
<td>- + + +</td>
<td>- + - +</td>
<td>- - - +</td>
<td>- + + +</td>
<td>- + + +</td>
</tr>
<tr>
<td>FEEL</td>
<td>- - + +</td>
<td>- - + +</td>
<td>- + - +</td>
<td>- + + +</td>
<td>- + + +</td>
</tr>
<tr>
<td>POSITIVE STATEMENT</td>
<td>- - + +</td>
<td>- - + +</td>
<td>- + - +</td>
<td>- + + +</td>
<td>- + + +</td>
</tr>
</tbody>
</table>

+ = Positive comment/statement
- = Negative comment/statement
x = No response
In the control group, less change was noted in student attitude when assessing the Think and Feel Chart responses. For example, student CD indicated 4 positive statements throughout the five week period. Student CC did improve from 1 of 5 positive statements or 20% to 2 of 5 or 40%. Comments such as, I feel ... “Awful! I can't do it,” and “Happy because I remember going over this in class, it will be easy,” were reported on this study instrument.

Tables 5 and 6 show the students responses on the Stress-O-Meter which asked them to indicate their stress levels prior to beginning independent work and again after they had completed it. The purpose was to assess if a change in stress levels occurred as students worked through the assignment. The numbers indicate the level of stress, with 10 being the highest and 0 showing no stress, students felt during this process.
### Student Responses on Stress-O-Meter
#### Experimental Group

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior</td>
<td>10,10,8,6,5</td>
<td>10,10,8,8,7</td>
<td>10,10,7,6,5</td>
<td>10,10,9,9,9</td>
<td>9,9,8,8,8</td>
</tr>
<tr>
<td>Mean</td>
<td>39 or 7.8</td>
<td>43 or 8.6</td>
<td>38 or 7.6</td>
<td>47 or 9.4</td>
<td>42 or 8.4</td>
</tr>
<tr>
<td>Post</td>
<td>9,9,7,6,5</td>
<td>10,10,8,7,6</td>
<td>10,9,5,5,5</td>
<td>10,9,9,8,7</td>
<td>9,9,8,8,7</td>
</tr>
<tr>
<td>Mean</td>
<td>36 or 7.2</td>
<td>41 or 8.2</td>
<td>34 or 6.8</td>
<td>43 or 8.6</td>
<td>41 or 8.2</td>
</tr>
<tr>
<td></td>
<td>Decrease .6</td>
<td>Decrease .4</td>
<td>Decrease .8</td>
<td>Decrease .8</td>
<td>Decrease .2</td>
</tr>
</tbody>
</table>

Table 5 represents the experimental group's responses on the Stress-O-Meter (see Appendix D). Students C and D showed the most significant decline in stress, as reported on the Stress-O-Meter indicator over the five week period of the study. Student C reported an average of 38 or 7.6, on the 10 point stress scale, prior to beginning mathematical tasks. This student's post assessment report showed an average stress level of 34 or 6.8. The overall level of stress reduction was .8. Student D posted a five week stress level average of 47 or 9.4 prior to beginning tasks and reported a post average of 43 or 8.6 which also showed a .8 reduction in stress. Student E indicated the lowest amount of stress reduction in the pre
and post reporting with a .2. All students in this group showed a reduction in reported stress.

**Student Responses on Stress-O-Meter**

**Control Group**

Table 6

<table>
<thead>
<tr>
<th></th>
<th>CA</th>
<th>CB</th>
<th>CC</th>
<th>CD</th>
<th>CE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior</td>
<td>8,8,8,7,5</td>
<td>9,5,8,7,6</td>
<td>10,10,10,9,9</td>
<td>8,5,5,6,4</td>
<td>10,10,10,9,9</td>
</tr>
<tr>
<td>Mean</td>
<td>36 or 7.2</td>
<td>35 or 7.0</td>
<td>48 or 9.6</td>
<td>28 or 5.6</td>
<td>48 or 9.6</td>
</tr>
<tr>
<td>Post</td>
<td>8,8,7,7,3</td>
<td>6,5,8,8,5</td>
<td>10,9,9,9,8</td>
<td>8,5,5,6,4</td>
<td>10,10,10,9,8</td>
</tr>
<tr>
<td>Mean</td>
<td>33 or 6.6</td>
<td>32 or 6.4</td>
<td>45 or 9.0</td>
<td>28 or 5.6</td>
<td>47 or 9.4</td>
</tr>
<tr>
<td></td>
<td>Decrease .6</td>
<td>Decrease .6</td>
<td>Decrease .6</td>
<td>No Change</td>
<td>Decrease .2</td>
</tr>
</tbody>
</table>

Table 6 shows the control group’s responses on the Stress-O-Meter. Three students, CA, CB and CC reported a .6 reduction in stress overall for the study period. Student CD indicated no reduction in stress with self-reported scores averaging 28 or 5.6. Student CE reported a decrease in stress of .2 on the 10 point scale.

The mean scores of overall reduction in stress for the experimental group was .56, while the control group’s mean showed .4 change over.
the course of the study. There was a difference of .16 which may indicate the interventions provided to the experimental group had positive results.

**Post Assessment Scores**

**Experimental Group**

Table 7

<table>
<thead>
<tr>
<th>STUDENTS</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCORE EARNED</td>
<td>2.5</td>
<td>3.5</td>
<td>1.5</td>
<td>2.5</td>
<td>4</td>
</tr>
</tbody>
</table>

The post assessment tool used was the same test as the pre-assessment to ensure the validity of the results (Discovery Education Inc., 2007).

Table 7 presents the scores of the experimental group on the post-assessment. This tool showed that four of the students raised their scores, while one student’s score showed no change. According to the assessment, student E’s score rose from a 2.8 on the pre-assessment to a level 3 on the post, reaching mastery. Student C also showed a .2
increase, reaching a level of 2.2. An increase of .1 was noted in students B and D. The pre and post assessment score for student A showed no change at a level 2.3.

**Post Assessment Scores**

**Control Group**

Table 8

![Bar chart showing post assessment scores for control group students CA, CB, CC, CD, CE.]

Table 8 reports that one student in the control group, CD, reported a post assessment score lower, 2.3, than that on the pre test, 2.5. This represents a decrease of .2. Student CC did not show any change from the first assessment to the post. Two students, CA and CE, both posted scores on the post assessment which were .1 higher than on the pre assessment. Student CB showed the greatest gain with a .2 increase in score from the pre assessment to the post.
Personal conferences were held with each student in the experimental group one time per week during the course of this study to discuss academic progress in mathematics, weekly goals, responsibilities and stress levels. Discussions also included observational behaviors in the classroom during instruction and work time.

Conferencing with student A focused on asking for assistance from the teacher during independent work time in the classroom setting and the completion of homework on a daily basis. Over the 5 week period, out of a possible twenty homework assignments, this student failed to complete 5 and the 6th was incomplete. The discussion centered on the need to practice new skills to improve performance, just as in sports, dancing, etc. The more you do, the better you get.

The student indicated he forgot to take the assignments home with him at the end of the day. He was shown how to use the academic planner provided by the school at the onset of the school year and the goal was put into place that he would see the teacher during study hall to assist him in completing the assignment chart daily and gathering all necessary paperwork and books to take home. A phone conference was held with the student’s parent to explain the goal and ask for assistance in assuring the work would be returned each day. By the end of the fifth week of this study, the student had improved his record of returning
homework by turning in 1 incomplete assignment during week three and all other assignments for weeks 4 and 5.

The student also indicated that attending study hall with the mathematics teacher from week two on, helped him to better understand the work being assigned and aided him in completing it at home. It was observed by the teacher that this student had limited knowledge of multiplication facts which was hampering his achievement. He was given a set of multiplication cards and agreed to practice them at home and was allowed to practice his facts by playing computer games which reinforce these skills daily during study hall.

The student further indicated that his stress levels decreased, as reported on the Stress-O-Meter, because he was feeling more confident asking for help in class and in small group instruction work. He also indicated in completing his homework, he was more knowledgeable of the material being covered.

Conferences with student B centered on completing homework assignments and focusing in class. The teacher observed the student staring into space frequently during lessons. During the second week of conferencing, it was decided, among both the teacher and student, to move the student's desk to the front of the class. This enabled the teacher to touch the student on the shoulder, tap her pencil or use other methods to regain the student's attention. The student indicated at the
end of week two, that his father had left the home recently leaving behind his mother, younger sister and himself. He stated that he "thought about his mother being home alone, while he and his sister were at school everyday." During week three, the school received notice that his address had changed, he and his family were living in a local motel until they could secure permanent housing. He did report during week three that he had moved, but did not share where the family was living except that it was in "town." He turned in one incomplete assignment during week three and all assignments for the final two weeks of the study. Prior to this he had missed 2 assignments in both week one and week two. He also attended block time and study hall to gain assistance with his homework. The teacher found at the beginning of this study that this student also had insufficient knowledge of multiplication facts necessary to successfully complete fifth grade mathematics. He too, was provided with multiplication cards to practice at home and allowed computer time during study hall to play games which enhance the learning of these skills.

This student's responses on the Stress-O-Meter and Think and Feel Chart during the course of the study could be reflective of the turmoil in his home life. He reported high levels of stress for the first two weeks of the study, with no change on the post reporting during this time. He also indicated negative responses for the first 3 weeks on what he was thinking before he started a mathematical task and 2 on the "feel" reporting
section. He did not respond on the “positive statement” section for week one and reported a negative response at the end of week 2. By week four, positive statements were found in all of these areas and continued through the end of the study.

Conferencing with student C focused on completing homework and attending study hall for assistance with homework assignments. During week one of the study, she completed only 1 of the homework assignments and 2 during week two. When asked why, she indicated, “I can’t do it and my mom and dad don’t know how to either!” She was asked to retrieve her math composition book which is used for notes in class from her locker. The teacher showed her how the steps to solve homework problems were contained inside and that this should be taken home every night to assist her in completing her assignments. It was further indicated that this could assist her parents in helping her with her homework.

It was decided by the teacher and student that she should attend study hall for further assistance. She indicated that she would like a peer tutor from the class. It was discussed who she would feel comfortable working with and why that person would enhance the learning process. The student chosen was acceptable to the teacher as she was a good role model and high achieving in mathematics. At the end of week two a second conference was scheduled and included the peer tutor choice of
student C. Student C, as instructed by the teacher in an attempt to assist her in taking control of her learning, asked for this student to assist her with homework assignments during study hall. A plan was devised which guided both through the process of what was expected from both she and the teacher.

This student also showed weak skills in the area of multiplication. She was also provided with a set of multiplication cards to study at home and with her peer-tutor, and allowed to spend fifteen minutes per day playing computer games which assist in learning these facts.

Student C reported stress levels on the Stress-O-Meter for weeks one and two at 10 for prior to beginning a mathematical task and levels of 10 and 9 respectively, as her post response. During the last three weeks of the study, she reported that her stress level had declined substantially, posting numbers of 7 and below. This also held true for her responses on the Think and Feel Chart.

During the final two conferences, student C, indicated that she “liked” working with her peer tutor and was “finally, getting it!” She further indicated that she “didn’t feel so stupid in class.”

The conference with student D focused on homework completion and her lack of knowing the multiplication facts necessary for grade 5 mathematics which prompted her statement, “it makes me feel lost; I take too long to do problems so I give up.” The student was asked if she
practiced her multiplication facts at home. She indicated that she did not. She was offered a set of multiplication cards to take home for practice but stated there was no one to help her there. She agreed to join the teacher for lunch, three days per week to work on these skills. Various methods were used to assist the student in learning such as, flash cards, computer games and alternative methods to arrive at correct answers.

Out of 20 possible completed homework assignments, the student completed 11. During week one, no assignments were completed. Weeks two and three, 2 assignments were completed and 3 during week four. The last week of the study, all assignments were completed. The student was given positive feedback regarding her progress and she responded, “I still have a lot of them (multiplication facts) to learn, but it’s getting easier and I don’t feel so lost!”

The responses of student D on the Stress-O-Meter and Think and Feel Chart supported her statement. During weeks one and two she reported level ten on prior to mathematical task work and level ten and 9 on post reporting. During week three, she posted level nine on both prior and post. For the remaining two weeks she continued to grade her stress at level nine on prior reporting. However, her post scores dropped to 8 for the fourth week and seven for week five. Her Think and Feel responses echoed her Stress-O-Meter scores. She indicated negative responses in all
areas for the first three weeks of the study and positive for the final two weeks.

Conferences with student E focused on self-confidence and stress reduction, since homework was not an issue. Out of 20 possible homework assignments, she had an incomplete on one and completed the nineteen others.

This student indicated that she had always been “good at math,” earning passing scores most of the time. She had hoped to be invited to participate in the accelerated math program in fifth grade. This invitation is extended at the end of grade four. Her parents were displeased with her “not making it,” and had mentioned frequently that “she had better get her math grade up.” She was pleased to find out that the ThinkLink test (Discovery Education, Inc., 2007) results were not being sent home. She was assured by the teacher that this would not happen.

The Stress-O-Meter and Think and Feel reports completed by student E reflected her level of concern. This student’s permanent record showed her achieving “outstanding” (overall grade of 95% and above), ratings for all but the last quarter in mathematics on her previous report cards. Despite this she reported high levels of stress and negative responses for the first two weeks of the study. During this time she rated her stress for both prior and post as level nine. For the remaining weeks
she reported level 8 for both areas except for week five. Here she posted a level seven stress for her post response.

Student E reported on the Think and Feel Chart negative responses in all areas for the first three weeks. During the last two weeks of the study, she indicated positive statements.

As these weekly reports were discussed during conferencing, the student was asked by the teacher what stress-reducing skills she was using which had been taught and reviewed in class. She stated breathing exercises seemed to work the best for her although, at times she found she had to leave the task and take a short break.

She reported her greatest fear was “disappointing her parents by getting bad grades.” She was asked what she considered “bad” grades, “I think that 90’s are alright, but my parents want 98% or better!” The teacher contacted the parents by phone and discussed the high levels of stress this student was exhibiting and how it was affecting her grades in an attempt to help them see the negative effects. They expressed their disappointment in her not being in accelerated math this year and wanted to know if she could be moved into that class if her performance improved. The teacher shared that her recommendation would be to focus on dealing with the high stress levels their daughter was facing and revisit this conversation later.
Chapter V

Conclusions and Recommendations

The purpose of this action research project was to assist students who indicated high levels of anxiety which resulted in their failure to meet academic benchmarks with the subject of mathematics. My hope was to help students' deal with their math anxiety, and provide them with the tools to find success in higher level math.

Looking at the results from the tables in chapter IV, it is apparent that the interventions which were put into place in the classroom of the experimental group, did assist the students in reducing their stress levels over the course of the study. For example, when comparing the scores on Table 1 with Table 8, the pre and post assessments of the experimental group, 4 of the students showed an increase in scores, with one reaching the benchmark of 3. Only one student's score showed no change and none of the student's scored lower on the post assessment than on the pre. However, this is not found in the data on the control group who received no interventions.

The data which indicated that the interventions had resulted in a positive difference for the experimental group is found in the Think and Feel Chart and the Stress-O-Meter. Over the course of the study, student responses on the Think and Feel Chart became more positive as the interventions progressed. This combined with the decrease in stress of all
participants as reported on the Stress-O-Meter, shows that reducing the level of stress students felt during mathematical operations, did result in a rise in academic performance.

The rise in students' scores may not be to mastery level, however, if the interventions were to continue, greater gain would probably be found for most students, based on previously mentioned statistics.

These findings correlate with the research which has proven the importance of the classroom environment, positive student and teacher attitudes, the value of peer tutoring, journaling and positive feedback from trusted educators, which develops over time.

Valuable information was gained from the student/teacher personal conferences which gave insight into each student's frame of mind, thought process and personal lives. These conversations forged not only a strong bond with the approachability of the teacher, which aided students in their mathematical capabilities; they also provided me with a glimpse into the stress they were bringing into the learning process at school from home. These outside, negative, life experiences did have an impact on a student's performance academically, as in the case of student B, as stated by Koppich (2006).

A factor for the small increase in score for some of the students in the post-assessment may have been due to the small group learning in which they received remediation or pre-teaching. The students were
placed into the whole group setting for the post assessment process. It is my recommendation that these students be provided with a small group environment whenever possible for assessments and gradually be moved back into the whole class setting.

As mentioned in Chapter 1, many of the students I have worked with have lacked the basic skills which higher level mathematics is build upon. Students A-D had below grade level knowledge of multiplication facts at the beginning of this study. These students were each given multiplication fact cards and encouraged to practice them for fifteen minutes each day while in study hall, and given time to use computer games which reinforce this skill, which could have resulted in their being able to complete more questions on the post-assessment correctly. However, having the opportunity to practice these skills and not having to feel ashamed while doing so in the classroom may have also helped reduce student stress and repair the cycle of feeling like a failure.

It is also my recommendation that AIS time be used to assist students with the basic skills they are lacking which cause them to under perform in the regular classroom beginning in third grade. Perhaps this intervention would prevent or reduce math anxiety earlier. Incorporating computer games and programs which reinforce these skills should also be part of the regular school day for these students.
If I were to repeat this study, I would create a method to measure the change in student class participation. I observed over the course of this project, the participants becoming more engaged in conversations which occurred during the teaching process. Often times, these students sat up straighter, asked questions and offered their thoughts more frequently which indicated to me that they were more interested and felt more secure during the process of learning than prior to the interventions.

Overall, I learned that many of the students in my math class benefited from the extra attention to the classroom environment which was enacted for this study. The non-verbal gestures, which allowed students who were not confident with the targeted learning to show their need for more teacher directed practice, have allowed students to ask for what they needed without reducing their self-esteem, have been invaluable. They will remain part of my regular classroom procedure. Also, I found great value in journaling within the math classroom. It is not valuable only for the students, but also for teachers to know and hear what their students are thinking and feeling. Even the most academically successful students have concerns which arise out of independent work which has been assigned to them. Providing this avenue allows teachers to deal with these concerns quickly to assure students they can achieve mastery of the subject of mathematics through hard work and teacher support.
References


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mathpanel/index.html


Appendix A

The Math Survey
Appendix A:
The Math Survey

The Math Survey

Name: (first name only) ____________________________

Gender: (circle one)  Male   Female   Age: _____

1. My best academic subject is ____________________________

2. I am good at it because ____________________________

3. I (like, dislike) math. Explain your answer. ____________________________

4. I feel that I am (good, not so good) at math. Explain your answer. ____________________________

5. Compared with other students in my class, I feel that I do (better, worse, about the same) as they do in math class. Explain your answer. ____________________________

6. When I am asked to do math problems, I feel (confident, worried, don't care). Explain your answer. ____________________________

7. Using manipulatives such as color tiles, place-value blocks and pattern blocks (does, does not) help me when I am trying to understand a new concept.
8. I like to work in a group (always, sometimes, never) when learning a new concept in math. Explain your answer.

9. When I grow up, I think that I (will, will not) use math. Explain your answer.

10. I think that my parents (like, dislike) math. Explain your answer.

11. My best experience in math was when

12. My worst experience in math was when

The Math Survey, Vanessa B. Stuart, January 2000
Appendix B

Adult Math Survey
Appendix B
Adult Math Survey

Please complete this survey with two adults and return it to me at our next meeting. Use one section for each adult you speak with.

In math lab, we are discussing how we use math in our daily lives. Please take a few minutes to complete this survey along with the child bringing it to you. Thank you for your time and assistance.

**Adult #1**

Name:_________________________________________ Job Title:________________________

Please circle the answer which applies to you.

A. I use math at home (daily, weekly, monthly, rarely).

Please list at least 3 ways you use math as part of your duties in your household.

1. 

2. 

3. 

B. I use math at work (daily, weekly, monthly, rarely).

Please list at least 3 ways you use math as part of your duties at your work place.

1. 

2. 

3. 
Name: ___________________________  Job Title: ___________________________

Please circle the answer which applies to you.

A. I use math at home (daily, weekly, monthly, rarely).

Please list at least 3 ways you use math as part of your duties in your household.

1. 

2. 

3. 

B. I use math at work (daily, weekly, monthly, rarely).

Please list at least 3 ways you use math as part of your duties at your workplace.

1. 

2. 

3.
Appendix C

Think and Feel Chart
Appendix C
Think and Feel Chart

Think and Feel Chart

Name: _______________________

I feel ...

I think ...

My positive statement is ...
Appendix D

Stress-O-Meter
Appendix D
Stress-O-Meter

**Stress-O-Meter**

**Directions:** On the stress line, circle the number which represents your level of stress at the beginning of this activity and again after it has been completed.

**Prior to activity**

0-1-2-3-4-5-6-7-8-9-10

1 = No stress
3 = A little stress
5 = Medium stress
7 = Very stressed
10 = Stressed out

**After the activity**

0-1-2-3-4-5-6-7-8-9-10

1 = No stress
2 = A little stress
5 = Medium stress
7 = Very stressed
10 = Stressed out
Appendix E

10 Ways to Reduce Stress
10 Ways to Reduce Stress

1. Overcome negative self-talk
2. Ask questions
3. Consider math a foreign language - it must be practiced
4. Don't rely on memorization to study mathematics
5. Get help the same day you don't understand
6. Be relaxed and comfortable while studying math
7. Talk mathematics - use the vocabulary
8. Be an active learner
9. Use calming techniques to ease your anxiety
10. Be responsible for your own success and failures
Appendix F

Classroom Constitution
Appendix F: Classroom Constitution

Classroom Constitution

We will respect:

* Other people and their property
* Our classroom
* Our building and grounds
* Our campus

We will show we are responsible by:

* Being honest
* Paying attention in class
* Completing all assignments
* Never preventing others from learning
* Respect all things, living and non-living

Consequences for not following our Constitution are:

* Private talk with the teacher
* Loss of privileges
* The teacher calling home and sent to “think it over” desk
* Student sent to “time out desk” and to construct a letter to parent/guardian with details of infraction
* Conference with parent, teacher and student
* Office referral