

What happens when I teach my seventh grade math students about math anxiety, and employ strategies to help them overcome their anxiety?

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Question in Context

I love the reaction I get when I tell people I am a middle school math teacher, and that I love my job. Between the hormonal age group and the country's most feared subject, most people think I am crazy. I will admit there are times when my passion for my student's success makes me crazy. These are the times where I give myself two options in order to maintain sanity. First, I seek new and innovative ways to reach, excite, and motivate the learner. Then, I simply tell myself that the world is full of adults who can not do seventh grade level math and some of my students will be those adults someday. I always try the first option for as long as I can, but every year- for at least a few students, I resort to the second option. There is one thing I never tried as part of the first option, and that has led me to this research question. Why are these students so hard to reach? Why are they completely tuned out and shut down when it comes to learning math? Where does their math anxiety stem from? I will teach these students about math anxiety, and help them face their fears head on to see if that will help me avoid resorting to option two this year.

Delta Middle School is a 7th and 8th grade building located in NJ. The school itself is within the one square mile of Delta Borough which has a bustling Main Street and blocks of large houses all converted into apartments. The remainder of the students come from a 10-mile radius that stretches over three very rural townships. We have about 350 students per grade level, 89% of which are white and 15% of which are on free or reduced lunch. Since we have such a large population of students, we have enough Hispanic, economically disadvantaged and special education students to create those three sub groups when analyzing standardized test scores. We are a Title One School, and

based on the No Child Left Behind (NCLB) criteria we are labeled a school in need of improvement. This status has created a lot of change and turmoil during my six years here.

My students come from four different K-6 districts so a huge effort of mine, as a seventh grade teacher, is just helping the students through the adjustment of merging into a completely new setting. In one sending district students never changed classes before, in another they have never ridden buses, and in the other two- they had a 5th/6th grade wing where they had a schedule that changed for every class and a locker! Furthermore, I have to even out the playing field with their math background as well. One of our sending districts has a math specialist who teaches 80 minutes of math everyday to homogeneous groups. The other extreme is a district where one teacher teaches all subject areas to the same heterogeneous group all day, which includes a 40 minute math period.

As a result of a being a “school in need of improvement,” we have received visits from members of the state department of education know as the Collaborative Assessment and Planning for Achievement (CAPA) Team. These visits have created a lot of tension among teachers and administrators, and the climate of the building has deteriorated. However, these visits have also brought on some positive changes. We have begun articulation amongst the math teachers of the sending districts. We meet every other month with all the middle school math teachers, our supervisor, and the sixth grade math teachers. Since we began these meetings two years ago, we have three of the four sending districts using the same textbook series as us: Connected Math.

Another change caused by the CAPA Team is that we are now departmentalized, which means all the language arts classrooms are grouped together, all the math

classrooms are located together, and so on. In order to do this, we had to abandon teaming, which was a great way to build community among students and to get to know them better. However, departmentalizing has made me a stronger math teacher because we have a common planning time in which to create innovative math activities and differentiated lessons.

Although this is my first teaching job, I feel I have gained a lot of experience through all the changes. There are six positions for math teachers in my building, and in my six years here, I have worked with 13 different math teachers, four of whom I have mentored. We rewrote the curriculum during my second year because it did not match the New Jersey Core Curriculum Content Standards, then we rewrote it again in my fourth year because we purchased the Connected Math series. In addition, every year I have taught at least one section that has students with special needs in the class accompanied by an in-class support teacher. The support teacher is not typically the same teacher every year. Over the years, I have taught with four different ICS teachers.

Beginning last year, my supervisor and I created a curriculum for Accelerated Math for the top 50 to 60 math students in the grade, and I have had the privilege to teach that class for the past two years as well. Removing these high achieving students from the general math classroom has changed the dynamics drastically. The good thing is the average student now shines as the brightest, but we find ourselves modifying the curriculum because the gaps in math skills are much more evident. Through this whirlwind of change I have experienced, one thing has remained the same. I still encounter underachieving students.

Early on during my first year of teaching, when my school was still set up in teams, I was at a team meeting where my mentor and team leader said something I will never forget. We were discussing struggling students which we did at least weekly at team meetings. I was still in “fantasy teaching” land, where I thought all my students would succeed because I would not let them fail. I would reteach and retest and keep them after school and call home and do whatever it took to foster their success. In this meeting I mentioned the name of a boy who I was having trouble getting to stay after school, and could not get the parents on the phone. My mentor and team leader said, “Oh, Brad, he’ll be repeating seventh grade next year, don’t worry too much about him.” My heart sank. How could she be so jaded and cynical? How could she dismiss a student’s potential so early on in the year? This was a woman who I otherwise very much respected. Just a few short years later, I found myself repeating those words.

There are just some students who seem to have no will to learn, or even willingness to try to learn. Most teachers call these students lazy or products of bad parenting, but I feel that some of them are just so deflated and discouraged from previous failure that they have given up, especially in math. They do not attempt to do homework because it is just one more place for them to experience frustration and failure. They avoid class work as much as possible by goofing around or spending ten minutes looking for a pencil because they are embarrassed of failure in front of their peers. In the past, I have tried several motivational and instructional tactics with this breed of student; sometimes with lasting positive results, sometimes with short-term positive results, and sometimes with no positive results at all. I could not help but think there has to be

something more to their math avoidance than laziness, bad parenting or even just low ability level.

Given this frustration, I wanted the focus of my paper to have something to do with these students who are failing math. What is the underlying cause of their failure and avoidance to try? I knew that question was too broad for my first formal teacher research experience. I can thank an African American boy named Clarence for helping me focus my thoughts and narrow my question. He has all the attributes that would make my first year mentor say, “Don’t worry too much, he’ll be repeating seventh grade again next year.” However, at the end of the first marking period, when I was feeling defeated for having none of my other strategies work with him, I asked him what his parents were going to think when they got his report card. He replied, “What? Math is the only subject I’m failing. I got D’s in everything else and a C in computers. I’m just *really* bad at math.” This was a little wake up call for me. Since we had abandon teaming, I do not often discuss student’s failure with other teachers, and I just assume if they are failing my class, they are failing across the board. Maybe it was not the students, maybe it was the subject. How many of my other struggling students were only really struggling in math? Did students accept failure of my subject before even walking into my classroom this year?

With a little research, I found that math anxiety is a very real issue and may contribute to failure in math. By educating myself about math anxiety, I hope I can teach my students about it, and they can face their fears and their reluctance to even try. Hopefully, if they face these fears with an awareness of the roots, they can build a sense of math confidence and find success in a math classroom. Therefore, the central question

for my research project is, “What happens when I teach my students about math anxiety and employ strategies to help them overcome it?”

Literature Review

As a middle school math teacher I am always searching for creative and engaging ways to help my students understand how to do math and why rules work in math. I always strive to create a positive classroom climate so students feel comfortable taking creative risks at problem solving and don't feel threatened to make mistakes. After researching math anxiety, I was pleased that some of my natural teaching and classroom management styles were ones recommended to prevent and repair this phenomenon. However, I realized that I needed to put all the pieces together, and make my students and myself more aware of the cause and effects of math anxiety. The themes that occurred in my research are:

1. Definitions of math anxiety and how it affects student's learning.
2. How and why math anxiety develops in so many learners.
3. Strategies to help students overcome math anxiety.
4. The positive outcomes of overcoming math anxiety.

The articles and books I read insist that math anxiety is a real concern that needs to be addressed in the classroom in order for students to become successful, math confident adults.

A description of math anxiety and how it affects students learning

Math anxiety is most simply defined by Leung and Cohen (2004) as, “A perpetual cycle of knowledge gaps and lack of confidence” (p. 1). It stems from a lack of understanding that may have occurred over several years or in just one lesson of

mathematics. That lack of understanding creates self doubt, which leads to anxiety toward the subject. When the anxiety becomes overwhelming, students will engage in avoidance behaviors which will begin the cycle all over. Obviously, if a student is avoiding the work, they are not likely to understand the material. To make matters worse, teachers may see the avoidance behaviors as misbehaviors and assume the student does not care to learn or is lazy. Once math anxiety sets in, the student feels, "Tension, apprehension and fear" (Leung & Cohen, 2004, p. 1). These feelings will interfere with his or her ability to use numbers and solve mathematical problems in a classroom and in real life.

The above can be thought of as a cycle of math avoidance: In phase one, the student experiences negative reactions to math situations. These may result from past negative experiences with math, and lead to a second phase in which the student avoids math situations. This avoidance leads to phase three, poor mathematics preparation, which brings them to phase four, poor math performance. This generates more negative experiences with math and brings us back to phase one. This cycle can repeat so often that the math anxious person becomes convinced they cannot do math, and the cycle is rarely broken (Pries & Biggs, 2001).

According to Fiore (1999), math anxiety is "The panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve a mathematical problem" (p. 403). Furner (2004) breaks the definition of math anxiety into two parts, cognitive and emotional. In a cognitive form, students worry about their performance. They worry about what their teacher, peers, and parents will think of their math ability. While some anxiety can be motivating, too much anxiety can cause,

"down shifting" in which "the brain's normal processing mechanisms begin to change by narrowing perceptions, inhibiting short term memory and behaving in more primal reactions" (McKee 2002, p. 2). The emotionality behind math anxiety is based on reactions evoked by stress. These reactions may include sweaty palms, nausea, or an inability to concentrate (Furner 2004).

After reading an intensive study done by Wigfield and Meece (1988), I understood the two parts of math anxiety more in depth. The cognitive component and emotional component are, "Empirically distinct, though they are correlated, and emotionality relates more strongly than worry (the cognitive component) to poor test performance" (Wigfield & Meece, 1988, p. 210). In this study, Wigfield and Meece (1988) actually used the Math Anxiety Rating Scale and correlated it to test scores over a two year period for 564 sixth to twelfth grade students. Students who worried more about their math performance attached more importance to the subject and exerted more effort. The authors deduced that some worry is needed to motivate learners, but if it becomes too strong, students will be bogged down with a fear of poor performance. That fear will induce the negative emotional state which was found to have the most impact on performance. Negative reactions to math will have one or more of the following effects: "Dislike of the subject, lack of confidence, discomfort, worry, dread, and/or frustration" (Wigfield & Meece, 1988, p. 214). The study also showed that math anxiety increased more with age than it did with gender.

I found another biological study done on math anxiety that helped me better understand the cognitive effects. Ashcraft and Kirk (2001) explain math anxiety as, "An on-line reduction in the available working-memory capacity of high-math-anxiety

individuals when their anxiety is aroused." The anxiety reaction involves attention to, or preoccupation with intrusive thoughts or worry. According to the researchers, "Students who do poorly on an exam claim that they become confused, are unable to focus on the task at hand, or keep thinking about how poor they are at math" This is consistent with their main result, "Math anxiety disrupts the on-going, task-relevant activities of working memory, slowing down performance and degrading its accuracy" (p. 236). What I found most interesting about their study was that it is not necessary to use conventional arithmetic and math problems to trigger the math anxiety reaction; it only needs to be a counting-like process (like counting through the letters in the alphabet). They also found no relationship between competence and math anxiety. This makes me believe that the anxiety is deep rooted and authentic.

How math anxiety develops in so many learners

Math anxiety can be traced back to the attitude displayed by a teacher or the method used to teach math. The way math is presented to students at an early age plays a critical role in their attitudes toward it (Furner, 2004). I came across many self help style articles written to help preservice teachers prepare themselves to teach math. Several elementary education majors feared teaching math because they recalled times they were, "Intimidated, misunderstood or belittled by a teacher in a math classroom" (Leung & Cohen, 2004, p. 2). These teachers suffer from math anxiety themselves. Other teachers are uncomfortable teaching math because of recent changes in curriculum or styles of teaching math. Leung and Cohen predict that the, "Disjointedness between teacher and curriculum results in more anxiety for students" (2004, p. 1). In some cases, teachers carry such personal negative attitudes towards math that their students begin to emulate

these feelings. They also suggest that other teachers want to break the cycle so they become better math teachers.

An entire chapter of Kogelman and Warren's book, *Mind over Math*, is written to make the reader aware of the "Math games others play on us" (1978, p. 80). When students are told they did a problem the wrong way, it automatically makes them feel bad, and is often not even true. Students may be answering the wrong question, but doing it the right way. Students may be getting the right answer, but in their own way. The process should always be looked at in more depth before a teacher assumes the student did a problem the wrong way. Additionally, teachers and parents create math anxious students every time they use phrases like, "You should know that," or "It's obvious," or "That's an easy problem" (Kogelman & Warren, 1978, p. 81-84). Imagine already being confused and frustrated- any of those phrases would leave one to doubt their self-worth and ability to ever understand the content.

There are several elementary classrooms where the teachers have positive attitudes towards math, yet fail to teach the subject in a way that really makes sense and connects to their student's lives. The students may learn the math in the moment, but the learning is not memorable so when topics are taught in the future, there may not be a firm foundation. Without foundation, the learning collapses and anxiety ensues (Leung & Cohen, 2004). Students never have a chance to develop a sense of how math topics are interconnected. The blame for this could be placed on the teacher, the pace teachers are expected to cover curriculum, or the organization of the curriculum itself (Skibba, 2008).

Another factor that leads to student's math anxiety is the faulty perception that all answers in math are either right or wrong. Often, students can recognize answers as right

or wrong, but cannot support why because they do not have that deeper layer of understanding (Skibba 2008). If students were able to think more critically about wrong answers, the wrong answers could be used as, “Windows into their thinking” (Skibba, 2008, p. 100). Most major mathematical theories were proven after studying years of wrong answers. Teachers tend to go overboard rewarding accuracy, which gives students the impression that if the right answer is *really* good, the wrong answer must be *really* bad (Tobias, 1993).

Just as others play games on us to provoke math anxiety, we play games on ourselves that make matters even worse. Math anxious students have a constant inner voice immobilizing them with thoughts like, "Everybody knows what to do, except me" or, "That was too simple, I must have done something wrong" (Kogleman & Warren, 1978, p. 71). When one feels they are the only one struggling, they are embarrassed to ask questions, and begin to feel alone and isolated on top of their confusion and anxiety. Most students do math under the false pretense that it is supposed to be hard. This belief may cause them to get suspicious and doubt themselves if a problem seems too easy. Every teacher has experienced grading a test and marking a question wrong while they can see the correct answer under scribbles or erasure marks. When something in math does come easily to students who usually struggle, they rarely enjoy the moment because they fear the complicated part that is sure to follow.

There are some societal factors behind math anxiety as well. Many adults recall math as being one of the first subjects to become difficult in school. These are the adults parenting our students, and perhaps giving them the impression that it is okay to just do

what they have to do to get by. We need to let the future of tomorrow know that it is okay to find things difficult, but it is not okay to give up.

Another source of math anxiety are the so-called "math myths" like, "Women can't do math; Some people can do math, others can't; My father/mother couldn't do math, either; I'm good at English-that's why I'm so bad at math; Insights into math have to come to you instantly; and If you can't solve a problem instantly, you should just quit" (Preis & Biggs, 2001, p. 6). One of the recorded sayings of a Barbie doll was, "Math class is tough." This clearly gives a negative message to little girls. This saying was removed upon protest by concerned individuals. Apparently it is okay to say, "I'm no good at math", while it is not okay to say, "I can't read." In fact, if a student hits some tough reading, he or she rereads it or revisits it later, while with a tough math problem, students believe they must get it on the first try or never (Preis & Biggs, 2001).

According to Ashcraft, "Aptitude is considered to be far more important than effort" (2002, page 181). Fortunately, math anxiety is not an inherited tendency, it is created-, and anything that was created can be removed.

Strategies to help students overcome math anxiety

In a perfect world, math anxiety would be avoided by not doing any of the things mentioned in the previous section. Since math anxiety is inevitable in at least some students, theorists have discussed strategies teachers can employ to help their students overcome their fears. Students must have good attitudes about math before they "Truly understand and develop confidence in their ability to do math" (Furner, 2004, p. 1). Before teaching content, teachers must show patience, sensitivity, and provide a caring environment. Furner (2004) describes math teachers as counselors that can help lower the

student's anxiety with positive messages and visualizations. He also recommends that math teachers help students understand how their math anxiety was created. Once the students are aware of their anxiety, they need to be motivated to overcome the fear of failure and avoidance (Leung & Cohen, 2004). Students may not even have the self awareness to know their own anxiety level (Skibba, 2008). It is suggested that teachers use journaling about math feelings to help their students learn about their "mathitudes" (Furner 2004).

Writing can be a powerful tool in helping students overcome math anxiety. Tobias (1993) suggests practicing "self-monitoring" while doing homework or studying by drawing a line down the middle of a student's homework paper. On one side they record their math work, but on the other side they write down their feelings and thoughts. These feelings and thoughts may seem disconnected or random, but they show us what we say to ourselves when we are under stress. This practice leads to an understanding of the obstacles we put up against our success. With practice, alternative thoughts can be suggested, and this process allows the student to keep working, breaking the paralysis of math anxiety.

Writing a math autobiography and encouraging positive math self-talk can also be helpful (Preis & Biggs, 2001). The math autobiography or "mathography" is a personal story of a student's math educational history. In those read by Fiore (1999), several of the students reported that a teacher or parent had called them "stupid", while others reported encouragement. The mathography is a tool that can help teachers get to better know the students, and help guide them away from feelings of anxiety.

Once teachers help their students become aware that they have feelings about math, teachers must try to put a positive spin on those feelings. Teachers should try to excite students with engaging lessons and by modeling an exciting attitude toward what they are teaching. When teachers strive to relate math to their student's life it will ease student's anxiety because students will begin to see math as a human endeavor (Furner, 2004). Conceptual understanding leads to less math anxiety, with less emphasis on memorization and drill, and more focus on authentic math. "Success for many students is related to how teachers make them feel in class" (Fiore, 1999, p. 405). Of course, teachers should encourage confidence in problem solving. If a student wants to take an obscure approach to solving a problem, the teacher needs to let them give it a try. This will allow students to see that the process of doing math is as important as the right answer (Furner, 2004).

Teachers need to be sensitive of their student's math anxieties. One way to do this is for the teacher to disclose his or her own math anxiety, and how it was overcome. Teachers can also inform students that the ability to do math is not "God Given," but rather takes years to develop (Jackson & Leffingwell, 1999), which reminds me of something I often say in my classroom when I introduce a new procedure and students erupt in confusion, "Don't worry- it took mathematicians years to figure out how to do this, I'm going to give you at least a couple more days!" It is partially a joke to add levity to the situation, but it is also a way to show students that I do not expect them be experts right away, and to remind them that mathematical procedures are not magic; it really did take years for each little step to be perfected.

Cooperative learning is recommended for the math anxious student. Students feel more comfortable speaking in small groups where they may obtain emotional support and academic assistance. More structured group activities reduce math anxiety because students with high math anxiety do not trust themselves to obtain correct answers so they prefer not to work alone. Additionally, they do not necessarily like discovery learning (Preis & Biggs, 2001). Skibba spent a few weeks analyzing her fourth graders' confidence in math class. She found that they could confidently complete a worksheet on division, but when faced with a division problem in context, they struggled. She found that by allowing her students to think aloud and share approaches to problem solving, their confidence and attitude seemed to improve.

The learner must also take responsibility for his or her own learning. Math anxiety rarely goes away by itself; it must be addressed as a primary concern by the sufferer to see improvement. It exists in many forms, degrees, and at many levels. Learners must be participants in mathematical problem solving. Most importantly, instructors must believe that each student can learn math, and must help students come to believe that they can do math (Preis & Biggs, 2001).

The positive outcomes of overcoming math anxiety

It seems obvious that if one is not anxious about something, he or she will have a greater chance of succeeding at it, which will open up doors for their future. It is stressed that our students need to be better prepared in a high tech world. This preparation starts in school where teachers need to address the math anxiety phenomenon in order to reduce it and produce confident math students, and confident, better prepared adults (Furner 2004). With confidence in place, people will be able to restructure problems so it makes sense to

them. It is harder to be a beginner at something as an adult so it is crucial to overcome discomfort with math early on, or else it may develop into full anxiety and avoidance.

In a study done by Blackington (2002) (see McKee, 2002) at Weber State University over a ten year period, it was found that students who did not take math continuously throughout high school fell increasingly behind in college. If a student was able to enter college with a fundamental knowledge of Algebra, he or she was 44% more likely to graduate. Clearly, if math anxiety is limiting a student's success in math, their career and life options may be severely diminished. However, with a successful program to decrease math anxiety, career goals can be met, with an overall increase of general confidence. Frances Rosamond of National University estimates that starting salaries go up by two thousand dollars for every math class taken past 9th grade. (Tobias, 1993)

Conclusion

It is clear that math anxiety is a real concern, and not just an excuse teachers or students use for poor performance. In fact, it should not be used as an excuse regardless of its validity. Teachers and students should be reassured that math anxiety is so well researched, and can be alleviated with proper attention and efforts. Both the learner and the instructor need to take deliberate steps to become aware of math anxiety, and constantly work toward avoiding and overcoming it. When strategies are in place to reduce anxiety, students will be able to attain more confidence and knowledge in mathematics, which will open up career opportunities in their future.

Methodology

Many of my students underachieve more so in math class than any other subject. I wanted to pinpoint who these students were, and explore what was holding them back. I

researched math anxiety, and it made perfect sense to me that some of my students were suffering from this.

First, I needed to choose a focus group of students so I surveyed all of them using a survey I found at mathpower.com titled, “Do you Have Math Anxiety? A Self Test” (See Appendix A). The survey has ten questions and the answer choices range from 1-strongly agree, to 5-strongly disagree. I wanted to use the survey informally so I briefly described math anxiety to each of my three regular leveled math classes, and told them I was curious to see their reaction to a couple questions. I had students stand on a tape line in the middle of the classroom. The wall on their right represented a response of one, or not at all. The wall on their left represented a response of 5, or strongly disagrees. I asked students to refrain from interacting, and to really reflect upon their feelings and experiences in order to give accurate answers. I also reminded them that questions were not asking how they felt about me, and I would not take their responses personally. With each question, students moved to express their reaction to the question as I recorded some field notes about their responses.

Prior to conducting this survey, I listed names of students who had been earning D’s or lower in my class while performing slightly higher in other classes. I paid close attention to where they moved in response to each survey question because I wanted to form my focus group with these “underachieving” students. I added a few names and crossed off others as they responded to the math anxiety survey. Finally, for each of my three math classes I had about six names listed as possible candidates for my focus group.

The next day I privately gave each of these students an invitation to join my math anxiety focus group that would be meeting during lunch once per week. The invitation

also served as a permission slip. I waited a few days for the permission slips to come back in, with gentle reminders to the students. Two girls from the same class brought them back the very next day. They seemed eager to participate. Other students politely told me that they did not feel like “joining” right now. I can understand the hardship of giving up your lunch period at that age! Other students continuously forgot to return the slips.

After about a week, I decided to take the eight complete forms I received and see what I could work out with the student’s lunch schedule and my own. This became a much more daunting task than I imagined. I was finally able to work out a common lunch among five of the students, who all happened to be from the same class- Block B, also known as the red class. I was weary about having the focus group all represent the same math class but soon after we started, I was glad that it happened that way. It allowed me to really hone in on the students of my focus group during our sessions as well as their math class. As I conducted my research, the entire red class became part of my story, with a special focus on Matt, Chelsea, Sophia, Amber, and Melissa.

I met with the focus group of five students once per week for six consecutive weeks. After week one Sophia stopped attending, and repeatedly apologized that she forgot. The other four students attended regularly with the exception of a few absences. I tape recorded each session, and wrote in my journal as soon as possible after the session. The journaling captured the most important ideas and helped guide me to develop topics for the next session. Audio taping allowed me to stay completely focused on conversing with my focus group and not worry about taking field notes.

The topics of the sessions were modified from *Mind Over Math* (Kogelman & Warren, 1978). Week one focused on understanding math anxiety, how they got it, and how bad they had it. Next we discussed “Games others play on us” (Kogelman & Warren, 1978, p.80) which I renamed, “Let’s blame others for our math problems.” During the third week we discussed “Math games we play on ourselves” (Kogelman & Warren, 1978, p.70) or, “Let’s blame ourselves for our math problems” as I called it. The fourth week we discussed having realistic expectations. We discussed overcoming internal barriers in the fifth week, and ended our session with a discussion of positive thinking in week six. During the six weeks we met I also made it a point to discuss math anxiety during class at least once per week while teaching the red class. I also put motivational sticky notes on the desk of the four students from my focus group. I always did this the day after a session as well as during a test or quiz. I used my journal to document these activities.

Instead of fully transcribing each half hour audio taped session, I just listened and wrote key points. Unfortunately I waited until the six weeks were over to listen to all three hours of audiotape. As I listened, I thought of more questions and topics I wanted to know more about. I also realized that some of the students in the focus group did not get the opportunity to share everything they wanted. There were times when they interrupted each other, and other times when I inadvertently redirected the conversation. I wanted to know more about certain things from certain students so I decided to conduct one on one interviews with each of the four students after the six sessions were complete. I taped recorded these 20 minute interviews.

I used the audio tapes from the six math anxiety sessions, the audio tape from the four student interviews, the class work, homework and quiz grades from the four students in my focus group, and my daily journal entries about the red class to help answer my central question: What happens when I teach my students about math anxiety and employ strategies to help them overcome it? While conducting this research, I also explored the following sub questions: Where did their math anxiety come from? How is the anxiety affecting their learning? How is the anxiety affecting their working memory, especially during tests and quizzes? How can I help my student overcome the anxiety?

Findings

“Math Anxiety is not an excuse for failure.” –Professor Freedman of mathpower.com

After reading my entire journal since the inception of this research project, which now includes notes from all six math anxiety sessions and the four student interviews, I found all the themes revolve around changing attitudes. It was almost like a contagious transformation in attitude swept over myself, the students in my focus group, and the entire red class. It is impossible to say who started the collective transformation, if anyone actually “started” it at all. It is more likely that the enhanced attitudes resulted from a chain reaction affect that swelled as positivity fed off of more positivity. My relationships with the students of the focus group immediately improved, which improved interactions in the classroom, which improved the climate of the class, which improved my mood and attitude while teaching them. The themes I will discuss as part of my findings are:

1. The change in my student’s attitudes toward themselves.
2. The change in my student’s attitudes toward learning math.

3. The change in my attitude towards my students.
4. The change in the tone and climate of the red class.

The change in my student's attitudes toward themselves

I observed my students speak positively about themselves after only two sessions. I was finally passing back their marking period two benchmarks that they took at least a week before I even started teaching about math anxiety. I was apprehensive because I knew the students of my math anxiety group were getting back scores that ranged from 48% to 77%. I was afraid these low scores would stifle any momentum we had gained in the sessions up to that point. As I gave Amber back her test with a 48% on it, I quietly whispered, "Its okay- that was a while ago." To my surprise, she enthusiastically responded back, "No- that's okay! It's almost double of what I scored on the first benchmark!" Sure enough, I looked in her folder and there was a 26% on her first benchmark. I patted her on the back and said, "Great improvement- and I think you'll double it again for the third marking period benchmark!" Chelsea overheard the conversation and chimed in, "I got almost 20 points higher than last time." I also congratulated her and fought the urge to immediately run over to my journal to document that experience.

At the next math anxiety session, I brought up the experience to once again commend their positive attitudes, and ask more about how they felt about it. I asked how they felt when I started passing out the benchmarks. Melissa responded, "Well I wanted to get it over with so I braced myself to be embarrassed." When I interviewed Melissa later I asked her to elaborate on when, why, and of whom she feels embarrassed. She told me that the initial embarrassment was because she felt bad for me! As if, she was

disappointing me by earning bad grades. She stated, “Now I don’t feel as bad because I know you understand that I want to do better and you know it’s not all my fault if I do bad.” This type of attitude change is important for developing feelings of self worth in the student, and creating positive teacher student relations.

During the first session we talked about how deep their anxiety was so we went over the questions from the survey in more detail. I reframed the questions so they were more open-ended. The question that generated the most passionate response from the students was about the fear of asking questions. Each student was eager to tell me about parents and siblings who made them feel bad about themselves for asking questions. Melissa shared, “I’m always being accused of asking stupid questions at home but I think it’s because my parents don’t even know the answer.” Matt shared that his older brother makes fun of him if he needs help with his homework. Chelsea admitted that her parent’s haven’t been able to help her with math since second grade, which makes her feel that math is not important because her parents have jobs and a house, and cannot do math either! They fed off of each other’s stories, and later during Amber’s interview she admitted, “I was happy to hear that I wasn’t the only one that didn’t get a lot of help at home. It usually leads to a fight for me if I ask for help so I try not to.” Amber realized that it is not her fault, and she is not alone.

During one of our sessions I taught them that zoning out and avoidance behaviors were a natural response to math anxiety. The body and mind is physically avoiding what makes it uneasy. I followed up on this concept during the interviews. I asked each student to close their eyes as I read them the “The Wall Fantasy,” from Cynthia Arem’s *Conquering Math Anxiety* (2003, p.37) (See Appendix C). What students do when they

face the wall symbolizes how they face a challenge. I knew how they previously faced a challenge, by avoiding it. Matt said he would try to climb the wall, Melissa would look for a door, Chelsea would try to walk into it to see if it moved, and only Amber said she would turn around and walk back the other way. I asked Amber why she would turn around, and she replied, "To get some help getting over the wall." Even her response did not symbolize giving up or avoiding the challenge!

The change in my student's attitudes toward learning math

My student's attitudes changed as they realized they were not alone in the challenges they faced. Once students understood that their feelings and experiences with math were shared with each other, I convinced them that it goes far beyond just them and middle school. I showed them all my books on the topic, and explained how they are geared to college students and adults that need to learn math for career advancement. Seeing these books made them realize that they are far from alone, and are actually ahead of the game by recognizing their anxiety as twelve and thirteen year olds.

The strongest point that Kogelman and Warren (1978) make in their self help book written to free adults from math anxiety is that, "Knowledge of the nature and causes of math anxiety aids in accepting that it is an emotional, not an intellectual problem" (p. 53). Understanding that there is an emotional problem may bring hope to the struggling math student, but it is not enough to just understand your feelings. The difficult part is how to take control of these feelings. I knew if I could get the students in my focus group to examine their reactions to math, it would lead to the ability to take control of these feelings.

However, it is not easy to get seventh graders to think on such an introspective level, especially about a topic they do not enjoy thinking about as it is. “You can work through an emotional block to doing math only by gaining both an emotional and intellectual understanding of how the block works, and how it inhibits performance” (Kogelman & Warren, 1978, p.60). I attempted to explain this concept to the students of my focus group, and decided to use a modified version of the story in *Mind Over Math* (Kogelman & Warren, 1978). The story is about things a person did during a typical day that involved numbers (see Appendix B). There are no questions asked in the story or at the end. I gave students a copy of the story, and told them I would read it aloud slowly, and they were to write down their feelings on the paper. The other task I requested was that they make up a problem of their own from any part of the story, but it had to be a problem that they could answer fairly easily. They were promised to be given plenty of time after I read it to go back and reread any part of the story. What happened in the next ten minutes astounded me.

First of all, they got completely hung up on writing a problem, and barely wrote any feelings or reactions to the story. The most I got was, “that’s hard” or “that’s confusing”. The students became preoccupied and excited about making up a question. Melissa’s question did not even match the story, Matt’s question was already answered in the story, and Amber’s question was way too hard for her to answer. After each of them stated their problem I asked how they would go about solving it. They each stammered and trailed off in their response as they realized something was wrong with their question or it was too hard for them. Chelsea went last, and I did not even get to ask her how she would solve her problem. She stated, “The problem I came up with is how much should

they leave for the 15% tip? Haha! I can NOT do percents!” The teacher in me could not hold back, and I said, “But Chelsea, you were asked to just make up any problem that you COULD solve.” I proceeded to gently point out the flaws with each of their questions. I could sense the students felt disappointed in themselves so I brought the conversation back to the importance of taking control over the math, and not letting it take control of them. We chalked that experience up to, “what not to do.” During the student interviews I attempted again to engage them in an opportunity to practice taking control of their emotions towards math, but was still unsuccessful in getting beyond the surface.

Each of the four students of the focus group, along with several students of the red class, have exhibited avoidance behaviors throughout the year. Matt would spend several minutes each period looking for materials and sharpening his pencil. Chelsea and Amber completed less than 50% of their homework during the first two marking periods, and Melissa was often drawing instead of paying attention. As their understanding of controlling their math anxiety evolved, all of these behaviors diminished. Chelsea and Amber did more than 80% of their homework in the third marking period, and Matt and Melissa spent more time on task. I know part of their change was that they knew I was specifically watching for an improvement in their math attitudes, but it was still a positive change that could not be ignored.

The change in my attitude towards my students

In the first session with my focus group I could sense that the students were nervous about what was expected of them so I was quick to explain that I was doing a self study, and that I was more interested in changing my attitude so I could be more understanding of students with math anxiety. Honestly, at the time I thought I was just

saying that to make them feel comfortable. Little did I know that it would become one of the most truthful and crucial part of my findings.

On November 18, before I even had my question clearly developed, I wrote in my journal:

I have a natural tendency to spend my time and efforts on the struggling students but it's tiring and frustrating when they don't meet me halfway. Sometimes I give up and show my frustration and that must make them feel even worse and want to shut down or act out.

It is human nature to become frustrated when your efforts are not being rewarded and you cannot understand why. With my new insights on math anxiety I was more patient and careful to hide my frustrations. I wrote in March:

I can't believe I never thought more about what it feels like to not get it, to be in a cloud. I've only ever thought about what I could do to make them get it- how I could use manipulatives, demonstrations, break down the concepts, bribe them to do work, etc. I never considered the emotional point of view of the student. I even thought of reframing my question: What happens when I become aware and respond to my student's math anxiety? Will my relationship with them improve? Will they be more willing to try and open up if they know I sympathize? Will it ease my frustrations? Will they enjoy math more with a teacher that "gets them"? Will they feel more comfortable? Does comfort create confidence?

I started thinking a lot about how I could stay cognizant to the anxious student's feelings, and I reflected on my teaching style. I realized that the speech I give on the first day of school is an attempt to ease math anxiety. I say things like, "If you've had bad

experiences in the past try to let them go; if you already feel like you don't like math, please try to give it fresh start with me." These are the right things to say, but I wonder how long into the year do my actions and my attitude support these words? I decided I would continue using my journal as an outlet for frustration and a means to monitor my attitude toward the students' math emotions.

The change in the tone and climate of the red class

I was so focused on the Matt, Melissa, Chelsea and Amber that it took me a while to step back and realize how their entire math class was transforming. It first hit me during the benchmark review on March 26 after which I journaled:

During the benchmark review there was a buzz of confidence and excitement. I set up stations around the room of the different topics we had learned during the marking period. I wanted there to be an expert at each station and I admittedly was worried about the red class when I conjured up this idea for a review. I was worried that no one would want to be or be able to be an expert in the red class. To my relief, the activity worked great and Melissa successfully served as an expert! The students stayed on task and followed all the directions.

This experience made me reflect more on the entire class. As stated before, it was a chain reaction. The students of the focus group minimized their avoidance behaviors, and it seemed others followed suit. The red class started following class routine better than ever! This put me in a better mood and energized me while teaching them. It became so much more rewarding to produce excited and proficient learners in the red class. In early March, I wrote:

I really look forward to teaching the red class these days. I can't tell if it's because Clarence has been moved to the alternative class, if I'm excited about my little experiment on math anxiety, or if they are just maturing in the second half of the year. It's probably a little of everything.

As a motivational tool, I reward one class per month with a game day. The criterion that counts towards winning game day is completely based on effort and behavior. I track things like homework completions, notebook checks, and everyone attempting the problem of the day. My blue class won in September, and then the yellow class won every month thereafter. The red class had barely ever come close-until March. They were so close to beating the yellow class and had shown such great improvement, that I decided to fudge the scores so they would be the winner. I keep the statistics on this challenge posted in the classroom, and when they walked in on the last day of March to see they had won, their reaction was brilliant. I was overwhelmed with pride as a group of students who I thought would be getting really difficult by this time of year, were celebrating in excitement to win a period of math games and snacks.

I taught myself to learn from, and enjoy the struggles of the students in the red class. Working closely with the focus group helped open my eyes to the things all students struggle with. Seeing that they were not alone with their math difficulties, and that it was not entirely their fault, helped my students feel more creditable. As those four students became more willing to learn, their peers followed suit and I became more willing to teach with empathy.

Implications

I learned so much more from this research project than I ever expected. I knew this was a self-study going into it, but I truly thought I would break students from their anxiety, and not learn much about myself. First of all, the notion of “breaking students from their anxiety” is something that I learned is immeasurable. It is not like math anxiety is a rash and you wake up one morning and notice that it is not there anymore. The four students of my focus group, and many members of the red class, will always be vulnerable to math anxiety. I have just taught them to recognize and be in control of it.

I always thought as a teacher that I was so tolerant, compassionate, and good at handling the troubled students. Well, yes, I am good at getting them to behave and be respectful, but I have shown less success in getting them to enjoy, appreciate, and understand mathematics. Now I know that I need to take the time to get to know their history as a math student as well as their feelings and apprehensions towards the subject. Next year, I plan on pinpointing the math anxious students early on, and inviting them to eat lunch with me periodically. I think just by letting them talk about their fear of math, and letting them know that they are not alone, it will help a great deal. It will also let them know that I do not just care about them behaving in class or doing their homework, I care about their entire past, present, and future as math students.

There are also things I am guilty of doing during class that I will become more aware of and curtail. I mentioned that I give a first day of school speech about starting on a clean slate in middle school, letting go of your dislike of math if you have one, and giving math a fresh start with Ms. DeMarino. I assure them that if they have the will I will find the way, and that everyone can succeed. There is even a huge banner in the front

of my room that reads, “Welcome to Success!” The message this all sends is perfect for easing anxiety, but I wonder for how long my attitude and nonverbal messages hold up to this philosophy. I know after just a few short weeks I sigh or roll my eyes when a student has no idea about the directions I just clearly stated, or claims he had no idea we had any homework, again. There is a fine line between having high expectations, yet being tolerant of the common math anxious behaviors, such as zoning out or avoiding work. I do not want students to view me as too easy, yet I want to help students overcome anxiety and certainly not be the cause of creating more anxiety.

The nice part about doing this self study so late in the school year is that my students and I have reached a nice comfort level. For the most part, they provide honest and constructive feedback when I ask for it. In a mini lesson on math anxiety, I addressed issues that came up high overall in the initial survey. One of these is the fear of being called on or asking questions. It had always been in my practice to call on students at random for certain questions by pulling a popsicles stick with their name on it. I knew it made some kids nervous, but I did not realize that the anxiety was actually distracting them from learning math. I explained how I would never hear from certain students if I completely stopped using the sticks. We came up with a compromise that I will continue using in the years to come. At the beginning of the period I would pick six sticks and those students would be “on the hook.” That meant that only their sticks were in the jar to be randomly called on, and the other students were off the hook for that class period.

Next year, we are starting a new schedule that includes a double block of math. With this extra time I plan on incorporating more things to get to know my students feelings toward math on a deeper level. We currently keep math journals on the “Big

Ideas” of topics we learn. I will devote a section of the journal for daily reflections to get in touch with their math emotions. Prompts will include: *Today I liked...*, *Today I was confused when...*, *Today I learned...*, and *Today I felt...* If I read and respond to these entries I will connect with my student’s attitude instead of strictly their aptitude.

Obstacles

As with anything that creates positive change and improvement, obstacles will stand in the way. It is not the obstacle itself, but how one tackles the obstacle, that truly determines how positive the outcome can be. When I reflect upon the obstacles I faced while conducting my teacher research, I recognize that some obstacles were created by outside forces while others were my own creation.

Finding a common lunch for at least five of the eight students who returned the permission slip was the major obstacle I faced from an outside force. At Delta Middle School, we have three different lunch periods within a four day rotation. I wanted to include Matt because his father had coincidentally contacted me in the fall asking what I knew about math anxiety because he suspected his son was experiencing it. I also wanted to include Emily because she already showed an interest in the topic and bought me a book called, *Math Doesn't Suck: How to Survive Middle-School Math Without Losing Your Mind or Breaking a Nail*, by Danica McKellar.

I was able to find five of the students that had a common lunch on one day of the rotation. I did not have that lunch but was able to get permission from my principal to switch my lunch so I was free to meet with them. This schedule was able to include Matt, but not Emily. I did end up using some ideas from Emily’s book during the sessions and

engaged in small talk with her on the topic whenever possible. She was a student of the red class so she was also exposed to my mini lessons on math anxiety.

The schedule I created had an embedded obstacle. Matt was the only boy. I could not think of why this was a problem right away, I just felt it was. It only took one session for me to realize the problem- he dominated the conversation and intimidated the girls. Matt is a polite young man, but he is very popular and outgoing while the girls in the focus group are more introverted.

If it only took one session for me to notice Matt dominated the conversations, it only took ten minutes of listening to the audiotape to realize I really dominated the conversation! I often asked directive or yes/no questions rather than open ended questions, and I caught myself rewording what the students were trying to say rather than just letting them talk through it. There were often sessions in which I had to teach them a facet of math anxiety, but I was too long-winded and wordy when I did so. I could have presented the concepts in a dialogue fashion. I never anticipated that this would be a problem because in the math classroom, I pride myself on asking good questions and presenting the material through class discussions. I must have been outside of my comfort level while teaching about math anxiety, and resorted to a flawed style. Between my overbearing style and the possible intimidation that Matt brought to the girls, I decided to conduct one on one interviews about two weeks after the last session.

These student interviews really helped me triangulate my data and get more data right where I needed it. I developed interview questions from comments the students made during the sessions. The interviews allowed me to obtain less inhibited responses and delve into specific topics that may have bored the other students and eaten away time

from our precious 30 minute sessions. Overall I feel I handled the obstacles as effectively as possible, but in my future teacher research I will monitor my behavior more closely as not to create unnecessary obstacles.

Emerging Questions

During the course of my research, I was unable to provoke the students to share, on a deep level, what they feel while they are doing math and what their emotional responses are while learning math. I suppose it is difficult for a seventh grader to be that introspective because the answers I did obtain were, “it’s hard,” or “I don’t like it.” One of my original questions that is still left unanswered is: How is the anxiety affecting their working memory, especially during tests and quizzes? I think I would need a lot more time or a focus group of older students in order to answer this.

Another question that came up for me is, with so many other factors, how can you really tell when math anxiety is an issue? Some students are dealing with crisis at home, depression, plain laziness, or stubbornness. I have probably taught just as many students who are truly intelligent but refuse to try, as I have students who suffer from math anxiety. What can be done to reach these students? Finally, how can teachers provide the right environment for students who are math anxious while stimulating and challenging the math eager?

Conclusion

I have spent six years teaching in a district under the influence of change and reform in attempt to meet demands of the state. Through it all, I have faced a population of students who underperform no matter how creatively I teach or diligently I insist upon them doing their work. I researched math anxiety to find it is a cyclical result of failure

and avoidance, often fueled by the attitudes of teachers and parents. To learn more about it first hand, I selected four students to meet with me weekly to learn how to identify and control their math anxiety. In doing this, we transitioned together as a group of people that better understood each other. The students were able to think more positively about themselves, and about learning math. I was able to feel their pain and better meet their needs. It is the start to a journey that I hope continues and expands to create less anxious math students of tomorrow.

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Appendix A

From <http://www.mathpower.com/anxtest.htm>

Do You Have Math Anxiety? A Self Test

Rate your answers from 1 to 5; add them up and check your score below.

(1) = Disagree, (5) = Agree.

1. I cringe when I have to go to math class. **1 2 3 4 5**
2. I am uneasy about going to the board in a math class. **1 2 3 4 5**
3. I am afraid to ask questions in math class. **1 2 3 4 5**
4. I am always worried about being called on in math class. **1 2 3 4 5**
5. I understand math now, but I worry that it's going to get really difficult soon. **1 2 3 4 5**
6. I tend to zone out in math class. **1 2 3 4 5**
7. I fear math tests more than any other kind. **1 2 3 4 5**
8. I don't know how to study for math tests. **1 2 3 4 5**
9. It's clear to me in math class, but when I go home it's like I was never there. **1 2 3 4 5**
10. I'm afraid I won't be able to keep up with the rest of the class. **1 2 3 4 5**

CHECK YOUR SCORE:

40-50 Sure thing, you have math anxiety.

30-39 No doubt! The thought of doing math still makes you uneasy.

20-29 Perhaps!

10-19 Wow! Possibly a math major in the making!

Math anxiety is an emotional reaction to mathematics based on a past unpleasant experience which harms future learning. A good experience learning mathematics can overcome these past feelings and success and future achievement in math can be attained.

Appendix B

A story about a typical day that involves numbers adapted from *Mind Over Math* by Kogelman and Warren (pg.61).

I really can't stand the heat today. It must be around 90° right now. Just a few days ago it was only 63° . I remember the heat wave we had in April; one day it was two degrees below freezing and the next it jumped to 95° .

I had some errands to run this morning before driving into Easton from Hackettstown. We had run out of stamps, so I went to the Post Office and bought two rolls of 42-cent stamps, a hundred to a roll, and a dispenser for 50 cents.

I had to stop for gas and only needed 4.8 gallons, which cost \$12.85. I realized I had gotten pretty good mileage on my VW since I had gone 144 miles since my last fill-up.

Joe and I met for lunch at "La Garbage." Joe ordered a rare steak for \$10.85 and coffee for \$.85. I had a chicken salad platter for \$8.75 and coffee. The waiter put everything on one check, but we decided we would each pay for what we had ordered. We left a 15% tip and went to a meeting.

- Matt's question: *How much did each stamp cost?*
- Melissa's question: *How much of a temperature change is it from -2° to 95° ?*
(Note, it was never -2° , it was "two degrees below freezing," which would be 30°)
- Amber's question: *How much would each person have to pay in the restaurant?*
- Chelsea's question: *How much do they need to leave as the 15% tip?*

Appendix C

The Wall Fantasy from Cynthia Arem's *Conquering Math Anxiety* (pg. 37).

Close your eyes. Imagine that you are walking along a road in the country. It is a beautiful day. The sun is shining warmly, but it is not too warm for comfort. The air is crisp and clear, and there is a gentle breeze that feels delightful as it glides past your cheek. The dirt beneath you feels warm and soothing to your feet. The fields on both sides of the road are lush, with vibrant, green, rolling hills. Oh, it is a beautiful day!

The road you are walking on leads up and down gentle hills. Feel yourself walking. Feel the gentle breeze blowing through your hair. Feel your arms swinging as you walk along.

The road makes a gradual curve and then, suddenly, your path is blocked by an enormous WALL. Walk up to the wall and feel its texture. As you look up, you see the wall stretching so high it seems to go into the clear blue sky above. To your right, the wall seems to stretch as far as the eye can see. And to your left, the wall stretches so far that it seems infinite. How do you feel? What do you do now? How do you proceed?

Subjectivity

This entire process was coated in subjectivity. From the students I choose, to the topics we discussed, to the details I chose to include in this paper. It was all my personal choice. Of course, I constantly audited myself to make sure my attitudes and assumptions were not taking my research too far off course so that it would still be a credible self study. I will share how subjectivity affected what I left out of this paper, how I audited my subjectivity, and what I learned about myself in the process.

There are certain times when adolescents say things that are just really hard to believe. When you are around middle school aged children long enough, sometimes you can just hear it in their voice when they are exaggerating or telling a story to impress, rather than inform. This is a subjective viewpoint, completely based on my assumptions and biases. I liked to get a rise out of people as an adolescent, so I probably did this a lot myself. During our second session that I called, "Let's Blame others for our Problems in Math," I believe a lot of this elaboration was an issue.

The four students in my focus group happen to represent each of the four sending districts. They knew very little about each other's lives prior to seventh grade, which opened up the gates for fabrication. As soon as Matt told his horror story about his 5th grade teacher, each of the three girls proceeded with a story. Each story outdid the one before it. I am not a detective, but I could hear in their voice and tell through their body language that they were making up some of the details of these stories as they went. The research does state that negative elementary experiences lead to math anxiety, so I am sure there was some element of truth in their stories. I choose to omit the stories anyway because of the suspected exaggerations and because I did not really find anything new

from their stories. They simply confirmed what the experts say about the development of math anxiety.

I wish I did a better job auditing my subjectivity during the six focus group sessions. I did write in my journal after each session, and then read it right before the next session. My intention was that I would review what we did the previous week and I could reflect upon my subjectivity to steer away from skewed outcomes. As much as I tried to audit my subjectivity in this fashion, it still emerged strong, which I immediately noticed when I listened to the six audio taped sessions in one sitting. When the students got wrapped up in what they were trying to say, I put words in their mouth. Those words were based upon my beliefs, not theirs! They never disagreed with what I suggested they were saying, but that does not mean that they did not want to. To further examine how this factor was affecting my data, I conducted the student interviews. During the interviews I brought up certain topics that I had directed their responses in originally. I was pleased that there were no major discrepancy between what had transpired in the original session and the interview. The interviews did not have a huge impact on my findings, except that they made me feel more secure in the validity of the student's voice from the sessions.

What I learned about myself is that I can talk the talk but I do not always walk the walk. What I mean by this is that if I were asked my strengths as a teacher, I would speak about developing good relationships with students through encouragement and mutual respect and about creating a positive classroom climate where everyone feels safe and can focus on learning. This is what I want to be as a teacher and who I am most of the

time, but I have been missing a big component to this. I had no empathy for the kids who were so emotionally beat up when it came to learning math.

I jumped through hoops for the students who I knew came from really bad home situations and the students who really struggled and did not even realize how bad they were at math. I even tolerated the smart kids who never felt like doing work. It was the students who were mediocre at math and did not seem to care or try, that I let go by the wayside. These are students who were suffering from math anxiety. Thanks to my interactions with Matt, Chelsea, Amber, and Melissa, along with their entire math class, I can change my approach to the math anxious student.

I used to think they were just too busy feeling sorry for themselves and should spend their efforts trying harder to learn. I now know that every math anxious student is in intricate case with a personal history. The only way to really meet their needs is to get to know what their feelings are, where they came from, and how to control them. This research has changed my attitudes and assumption about my seventh grade math students who are shut down to math before they ever walk into my classroom.

Implementation Plan

It is so important to avoid creating math anxious students in the primary grades. For this reason, I feel I need to get the message out to parents and elementary school teachers. My approach must be well planned because if they have ever even heard of math anxiety, I am afraid they may view it as a cop-out or an excuse. I need to relay the information about math anxiety in a realistic and critical manner, without seeming as though I am pointing the finger at anyone for my current student's anxiety issues. This job will not be easy, but at least I already have a forum to reach both the parents and the elementary teachers. As a math department, we have bi-monthly round table meetings with sixth grade math teachers from our four constituent districts. Additionally, we host Math Night for parents each marking period. The overarching goal of these meetings is to improve the quality of education of the students, an umbrella which my cause falls under. My supervisor would be happy to allow me to include math anxiety as a topic in both settings.

With each of my groups, I will grab their attention with these situations, adapted from Dave Wood's workshop, *Coping with Math Anxiety*:

Imagine the following situation: Recently I was eating in a restaurant where I sat next to a table of five people who looked to be in their mid twenties. The waitress brought them their bill and I could not help noticing that they were struggling to figure out how to divide it up and how much to leave for a tip. This went on for a while when finally one of them said: "Isn't it funny that we are all graduate students and we can't figure out the bill?"

Now imagine this situation: Five people walk into a restaurant and are seated. The waitress brings each of them a menu. They all sit quietly for a while until finally one of them says, “Isn’t it funny that we are all graduate students and none of us can read these menus.

Do you think that this is as likely to happen as the first scenario?

With this, I hope my audiences recognize that math anxiety is a reality and is no laughing matter.

When I have the opportunity to share my knowledge on math anxiety with the sixth grade teachers, I will give a brief overview of what I found in my literature review and see what they already know and feel on the topic. I also plan to share with them my story of this self-study, including some of the things the students said about how their anxiety was created. This will allow me to dovetail into the main topic: what can be done at the elementary level to avoid creating math anxious students. I will also enlist their help to relay the message to the teachers of younger grades in their school. I hope to create a general awareness and interest in the topic. Even if one teacher in one building stops using the phrase, “That should be easy,” I will consider my efforts a success.

My next audience is the parents and I know it will be more difficult for me because I suffer from parent anxiety! As a young teacher with no children yet myself, I fear parents will think it is not my place to tell them anything. I will make it personal by asking if any of them think they have experienced math anxiety, or a situation similar to scene one in the restaurant. The main thing I need to convince them of is that they are their childrens biggest role models, even when it comes to education. I will share Chelsea’s statement, “My parent’s haven’t been able to help me since second grade so I

don't even bother asking them for help. If it's too hard for me, I just don't do it." And Melissa's experience, "My mom says- 'You should know this!' Then she gets my brother over to help. We usually get into a fight, and then my dad comes in. Next thing I know it's like the whole room is helping me! I feel so stupid." I hope some parents will want to share similar stories.

Once I have convinced them of the reality of math anxiety and taught them some ways to identify it, I need to give them strategies to avoid adding anxiety into their children's math experiences. They need to be proactive in their approach to helping with homework. There needs to be a plan that involves when the child is allowed to ask for help so they are not asking while the parent is too busy. The parent also needs to have a plan for what to do when they do not know the answer or how to help. Matt shared, "My dad always sighs when I ask him a math question. At first I thought it was because I was bothering him, but then he told me it was because he was thinking of how to explain it without just giving me the answer." Most parents are not trained nor experienced in teaching math curriculum, so it is acceptable that they need time to relearn the material and think about how to explain it to their child. I will let parents know it is okay to say, "I haven't done this in awhile, let me look it up in your book or online and think about how I can help you." However it is not okay to say, "I don't remember any of this! Why didn't you just pay attention in class?" That sends the message that math is not important to the parent and puts the blame onto the child for not being able to do the homework.

It is important to inform all my audiences of what math anxiety looks like, without accepting it as an excuse for failure. Math anxiety looks like students zoning out during class, avoiding work, forgetting to bring their homework home, and giving up.

The tricky part is that students that are not math anxious could exhibit some of these same behaviors. It is imperative for a teacher or parent to understand why their child or student is displaying these actions. Once the anxiety is recognized, it can be dealt with. As stated before, math anxiety is a learned behavior that can be unlearned with practice and patience.