WORKING WITH ADULTS WITH MATH PHOBIA

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Abstract

WORKING WITH ADULTS WITH MATH PHOBIA

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This paper examines the causes and effects of math phobia in adults. A review of literature focuses on the research of math phobia and what can be done to help adults overcome the problem.

Research shows the causes of math phobia vary from person to person, but tend to center on negative experiences in school around third or fourth grade. The negative experiences cause anxiety for the student. Anxiety affects the working memory of the brain, the same area used to do math calculations. As anxiety increases, the student is less able to do the math, creating even more anxiety.

Teaching methods to improve math skills will do little if the anxiety is not addressed. Instructors need to address the anxiety as well as the skills in order for the student to advance.

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Chapter One: Introduction

Imagine going out to dinner with friends. The bill comes and no one can figure out what the tip should be. The thought of numbers is overwhelming, so the customer just pulls out a $5 bill instead of figuring it out. This very real situation called math phobia affects many people.

Math phobia is a very real and debilitating condition for many adults. The condition affects every area of life. Simple tasks such as taking measurements to determine what size clothing to order become overwhelming. More complicated tasks such as understanding how a mortgage works are almost impossible because they are so daunting. The sight of numbers creates panic; knowing something needs to be done with those numbers is even worse.

Math phobia is not a minor problem. Math phobia affects the daily lives of approximately 20% of adults, while as many as 66% suffer from it to some degree. Many people have difficulty dealing with money. During the recent mortgage crisis, a large percentage of those who lost their homes suffered from math phobia: because they were so paralyzed by the numbers, they did not realize the problem they faced (Gupta, n.d., Burns, 1998).

Several legitimate factors contribute to and increase the severity of math phobia. In many cases a parent's own insecurities about math are transferred to the child and then are carried over into adulthood. Peers have a large influence on how children feel about math, especially girls. Math is an accumulative subject; students need to grasp one concept in order to move onto the next. If one skill is missed, the students find it very difficult to move onto the next subject; and will fall more and more behind. This seems to be at the root of math phobia.

Teachers working with adults who have math phobia need to develop strategies to help these students overcome their fears. Teaching math to adults is much like sports. The ability to do math is ninety percent (90%) mental attitude or confidence building and only 10% is math

skill (Stuart, 2000). Adults who are affected by math phobia need help to understand that they can do math and will slowly develop the confidence to move on and overcome their fears.

Statement of the Problem

The problem to be addressed is what strategies are most effective in assisting adults with math phobia?

Definition of Terms

An **adult** is a person who is fully developed and mature. In most cases a person over 21 years of age is considered to be an adult (Merriam-Webster, n.d.)

Adult learning is the process adults go through to learn a new concept or skill. This can be through formal learning situations such as colleges or workplace training, or more informally through reading a daily newspaper or life experiences (How Adults learn, n.d.).

Math Phobia is described as an intense, persistent, often illogical, fear of not succeeding in math. Persons experiencing math phobia hold the belief that they are unable to handle the difficulty associated with learning math or believes that they "can't" do math (Rapalje, 1997.)

Delimitations of Research

The research will be conducted in and through the Karrmann Library at the University of Wisconsin-Platteville over 45 days. Primary searches will be conducted via the Internet through EBSCO host with ERIC and Academic Search Elite as the primary sources. Key search topics included "math phobia," "math education methods," "math fear," "math anxiety," and "overcoming math fears."

Method of Approach

A brief review of literature will be conducted on the approaches taken to identify math phobia and the methods used to support those identified as having the condition. The findings will be summarized and recommendations made.

Chapter Two: Review of Related Literature

Effects of Math Phobia

To adults who have succeeded in math, the idea of a phobia of math is foreign. However, it is a real issue in America. Math phobia is an important issue to address and to overcome because math is something that a "disturbingly large percentage of the American populations fears and loathes" (Burns, 1998). Burns argues that math phobia is a serious national problem because it limits people's daily lives and their long-term decisions (Li, 2003).

Adults use math every day for everything from shopping for groceries to deciding how much fertilizer to buy for the lawn to planning a household budget. In addition to such activities, the skills developed to do math, logic and reasoning, are important to the problem solving adults need to succeed in many aspects of life. If an adult is lacking or does not have confidence in his or her skills, math phobia develops.

The American Psychological Association has a diagnostic code for math phobia: 315.1 - Mathematics Disorder. To determine if math phobia exists, there are three areas that are looked at in comparison with the individual's age, general intelligence, and education level. The first measurement is standardized testing results to determine if the person's mathematical ability is substantially less than is expected. The math deficiency can be increased if there is also a sensory defect. After review of this information determines that a deficiency does exists, it is studied to see if it impedes academic achievement or daily life (Disorder information sheet, n.d.).

Adults with math phobia often participate in avoidance behaviors. In academic settings, students will pick a major or course of study based on whether a math class is required, thus altering the path of the career. Often times, they do not balance a checkbook or enter into contracts based on the advice of others because they do not understand how money works. For

example, adults with math phobia may enter mortgage agreements they cannot afford, but because they fear numbers or do not understand the numbers, they tend to agree with what the mortgage broker says. This type of avoidance strategy can cause devastating financial consequences for the individual or family.

Math phobia results in physical symptoms as well. Adults may experience four different symptoms of math phobia: panic, paranoia, passive behavior, or avoidance and a lack of confidence (Symptoms and causes, 2010)

Having anxiety about math becomes a self-fulfilling prophecy. Research at Straffordshire University shows that anxiety affects the same areas of the brain as the resources needed to perform math. Anxiety affects the working memory, which is the memory needed to do math calculations. Adults and children become anxious about a situation associated with math, usually testing. The ability to do math is reduced so they become more anxious about testing and the cycle continues (Gray, 2005).

Additional studies done at Cleveland State University looked at the relationship between short-term or working memory and math phobia. Early studies into math phobia, begun in the early 1970's, focused on the psychometric aspects of the condition. It was noted that adults who sought treatment for their phobia only, saw a significant improvement in the math grades with little or no additional assistance in math. Others who sought treatment and continued to work on their math skills at the same time saw about the same amount of improvement. On the contrary, adults suffering from other forms of academic phobias, for example, writing, did not see as significant an improvement. This prompted researchers to look into the relationship between math phobia and the working memory needed to perform math (Ashcraft & Kirk, 2001).

In comparing students with a high level of math anxiety to students with low level math anxiety, researchers did not typically note performance differences on basic whole number facts of simple addition or multiplication (e.g., 7 + 9, 6 X 8). As soon as the difficulty was increased to two-column addition where carrying was involved (e.g. 27 + 18, 15 X 5), the performance differences became evident. High level math anxiety students took nearly three times as long to complete the assessment as low level math anxiety students. The researchers also noted that there was a higher error rate on these problems showing a classic speed-accuracy tradeoff when confronted with more difficult material. This indicated a willingness to sacrifice accuracy on especially difficult trials, either to avoid having to deal with the math problems or merely to get done with the problems faster (Ashcraft & Kirk, 2001).

Subjects were also given the problems in a paper/pencil format and an oral format. For the purposes of the experiment, the subjects were divided into three groups: low, medium, and high math anxiety levels. While all three groups did better in the paper/pencil test over the oral test, the high math anxiety group did significantly worse than the other two groups on the more difficult problems. There appeared to be no difference on simple, one column problems.

The processing efficiency theory is a model of the "anxiety-to-performance relationship in cognitive tasks such as math. This theory states that performance deficits due to generalized anxiety will be prominently in exactly those tasks that tap the limited capacity of working memory." (Ashcraft & Kirk, 2001). The intrusive thought and worry characteristic of high anxiety are thought to compete with the cognitive tasks, such as math, for the limited resources of the working memory. The result is either a slowing of performance or a decline in accuracy.

To test the theory, researchers compared the three groups (low, medium and high math anxiety) to two different areas of working memory function, computation or C-span, and

listening or L-span. When doing activities that involved the C-span, those with high math anxiety took longer and had significantly more errors than those who had low math anxiety. When participating in activities that involved the L-span part of the memory, there was little to no difference between the groups.

The researchers were able to determine that any anxiety affects the C-span part of the working memory, the same part that is required for math computation. The result is lowered capacity in the working memory. When considering two function math (e.g. 27 + 65), people with math phobia essentially are dealing with three functions, the two parts of the math and the anxiety, taking up the limited working memory space. Couple that with the fact that people with high math anxiety participant in avoidance strategies so they do not practice math skills as often, a self-fulfilling prophecy of math phobia becomes evident (Ashcraft & Kirk, 2001).

Causes of Math Phobia

Adults have experiences that can cause or contribute to any phobia. With math phobia, the research recognizes three main causes: family influences, the way math is taught, and societal factors.

Family influences

Many parents think that academic ability is do math is genetic. If the parents were unable to do math or struggled with it, their children will as well. Burns states it as "math phobia is not genetic but highly contagious" (Burns, 1998). Parents tell their children that math is hard or how hard they had to work at math. This puts the negative images about math into the child's thoughts. This is especially true with girls. Many believe that girls are not as good as boys when it comes to math, but that girls are better than boys when it comes to reading. As this believe

perpetuates through generations, it becomes a self-fulfilling prophecy with generations of girls believing they are programmed to not be able to do math.

The Way Math Is Taught and Assessed

In research done in conjunction with pre-service teacher education at Lakehead University in Canada, 16% of pre-service teachers attribute math phobia to experiences in the third or fourth grade, specifically to working with fractions and memorizing multiplication tables. Another 26% can relate it to specific incidences in middle and high school. Brady and Bowd (2005) listed a number of pedagogical practices that contribute to the problem. They include (a) The assumption on the part of many math teachers that math processes and procedures were inherently simple and self explanatory; (b) the use of the unique vocabulary of math without sufficient explanation of the meaning of the terminology being used; (c) an overuse of "skill and drill" exercises which contribute to frustration and anxiety; (d) the sequential nature of math instruction which makes keeping pace with the class difficult if the skill is not immediately grasped (e) an overemphasis on rote memory and (f) the fact that math tends to be taught in isolation, with little connection to the "real world." In addition, the research identified behaviors of teachers as a major contributor to the development of math phobia. They point to math teachers being characterized as hostile or insensitive. The survey results showed some common themes such as derogatory comments about the students in front of their peers, demonstrating impatience when students requested assistance, or pointing out student errors to the whole class. Gender bias was also evident as girls were ridiculed more often than boys and received less additional assistance when they encountered difficulty (Brady & Bowd, 2005).

This research is significant because it is noted that a lack of knowledge or a poor attitude toward math may inhibit the learning about math and math instructional methods during pre-

service studies and later their use of effective methods of teaching math. Negative attitudes toward math can produce negative results in math and teachers with math phobia may foster the early development of math anxiety among their students. Elementary teachers scoring higher on measures of math anxiety, such as the MARS (Mathematics Anxiety Rating Scale) developed in the 1972 by Richardson and Suinn, were found to spend less time planning math lessons and using math instruction time for non-math related activities. This was compared to teachers who scored lowered on the MARS. (Brady & Bowd, 2005)

The University of Chicago researched whether teachers transmitted their anxiety about math and reading to their students. The study involved 17 first and second grade teachers and their students. During the year long study the 17 teachers had 52 boys and 65 girls in their classrooms. At the beginning of the year, the teachers' attitudes about math were surveyed. The research team also surveyed the students' feelings about math at the beginning and the end of the year (Beilock, Gunderson, Ramirez, & Levine, n.d.).

At the beginning of the school year, student math achievement was unrelated to teacher math anxiety in both boys and girls. By the end of the school year, however, the more anxious teachers were about math, the more likely girls, but not boys, were to endorse the view that "boys are good at math and girls are good at reading." Girls who accepted this stereotype did significantly worse on math achievement measures at the end of the school year than girls who did not accept the stereotype and than boys overall (Beilock, Gunderson, Ramirez, & Levine, n.d.).

In research about ways to teach math using technology, Qing Li (2003) noted a significant relationship between the teachers' own math phobia and their experiences with diversity and how it impacted their students in the classroom. He noted that in individual

meetings with the teachers who were taking the online classes, only a small percentage were willing to admit they had math phobia. However, in discussions online during the class, many more experiences with math phobia came out. Through the discussions, the researcher noticed three variables that affected the teacher's math phobia:

Teachers often teach math in accordance with their own attitudes towards math. There is a trend towards looking at the process instead of the end product in math. Teachers realize this is the best way to have students learn the logic behind the process. Teachers identified assessments as a source of math phobia as well. No single assessment method, particularly timed tests, could fully assess student achievement (Deniz and Uldas, 2008).

Math students are placed in many situations, such as completing a problem on the board, where they feel a sense of threat, inadequacy, and embarrassment because the experience is so public. Just one incident under such a circumstance can cause a lifelong math phobia. These situations in the classroom are often brought on by teachers who are insensitive to student fears and the impact the humiliation this may cause. They may also be inadequate in their fields or have their own levels of math anxiety (Deniz and Uldas, 2008).

Many times the focus in math class is on the end result and not on the process. There is an emphasis on the "rules" of math, especially early on. This can impact a student who is a kinesthetic learner or who has difficulty memorizing.

Other social factors

Other factors contribute to math phobia. In 1992, Mattel introduced the talking Barbie ® doll. One of the things this doll said was, "Math is hard!" This started a debate about the stereotype that girls are bad at math.

In studies done at the University of Michigan, women who all tested equally on the SAT scores were given a set of difficult math problems to solve. When told that gender could not affect the scores, the women did as well as men given the same test. Another group was given the same test but were not given the same instructions. Their scores were significantly lower than men. The study revealed the women assumed their math skills were being evaluated and this affected their performance. The study was repeated with white males. This group was told Asian-Americans were better at math. The group that was given this instruction did much worse than the group that was given no instructions. The conclusion is the fear of confirmation negative stereotypes can hurt performance (Lehrman, 2005).

In 2001, actress Rosie O'Donnell started a debate over math when she stated in Newsweek magazine: "I think there's no way they should have to teach [math] now. We have computers. We no longer need to know why 3x=2y/4".

Examples like these show a societal trend to minimize the need for math. This increases math phobia because adults are unwilling to overcome it if they do not think it is important. In fact, the opposite is true. Math not only teaches the steps to do a problem but it also involves developing and using logic. This is something adults use in everyday life to make decisions and problem solve. Formal math may not be used everyday, but logic is used every day. As Ertekin, Dilmac and Yazici reported in their study, "Societies which are aware of the importance of mathematics, and which base their teaching of new generations on thinking skills and reasoning will be at the forefront in all fields in the future" (Ertekin, Dilmac, & Yazici, 2009).

How learning styles affect Math Phobia

Three main learning styles or learning preferences have been identified: audio, visual, and kinesthetic. All adults have some of all three but usually one can be identified as the most

favored. Audio learners tend to learn best by hearing. Because of the way math has been traditionally taught, audio learners do tend to do better. Visual learners do best by watching. In traditional math education, visual learners tend not to be as effective as audio learners. Kinesthetic learners learn best by doing. This is where traditional math education has failed. Most math has been taught verbally leaving the visual and kinesthetic learner behind. (Ertekin, Dilmac, & Yazici, 2009). Math is a cumulative subject. This means that if the student does not understand one concept he or she cannot move on to the next skill, and the student falls further and further behind. If teachers teach in only one or two ways, the students who prefer to learn differently may not be able to keep up. Many teachers have been trained to teach math to obtain results in the quickest way and without causing problems so students can "pass the test." Many teachers believe that math is a set of rules to be memorized and design activities around those rules (Ertekin, Dilmac, & Yazici, 2009).

A trend over the last few years has been to focus more on the process of math and not the end product. This is best for those whose learning preference is kinesthetic. This trend is similar to the constructivist philosophy, which promotes learning by doing as opposed to the behaviorist philosophy which promotes learning by promoting positive behavior changes (Ertekin, Dilmac, & Yazici, 2009).

Research into the relationship between learning style or preference and teaching styles has pointed out that inconsistency between an instructor's teaching style and a student's preferred learning style negatively affects academic achievement in math. In a study done with undergraduates, the researcher found that if there was a consistency with the student's preferred learning style and the teacher's preferred teaching style, there were significant increases in the learner's achievement in the classroom (Lindsey, 1999).

Another study reported that an inconsistency between the learner's preferred style and the teacher's preferred teaching style negatively influenced the student's learning and his or her attitudes towards the subject. This study focused on language learning. However, based on the research done by Lindsey, a correlation can be made to the study of math as well (Felder and Henriques, 1995).

Based on this research, it can be determined that a teacher's preferred teaching style is among the behaviors which are considered to be sources of math anxiety. When a teacher's teaching method is inconsistent with the learner's preferred learning style, the students will withdraw from the lesson. This explains many adults' attitudes towards math and the development of math phobia.

In their research with students entering teacher education programs, Ertekin, Dilmac, and Yazici (2009) noted a significant negative correlation of students with a high level of math anxiety and kinesthetic learners and visual learners. Kinesthetic learners had a higher correlation than visual learners. These findings confirm that traditional teaching methods for math favor learners with an auditory learning preference.

The authors of this study also looked at other factors such as social interaction, amount of light needed, authority, time, and perseverance. Those who rated high in perseverance had a higher rate of math phobia than those who rated high in authority, the need to have someone direct the learning process. There was little correlation between time and amount of light needed and math phobia.

When participating in math activities in daily life, the research shows an increase in math phobia for the person needing authority. The researcher feels this is because in daily life the student does not have the authority figure available to assist in completing the activity. Those

with a kinesthetic learning preference experience a decrease in anxiety levels when lessons were taught using real world examples.

Teaching methods that have been effective in overcoming math phobia

When adults with math phobia study math, the first step is to identify the problem and find the best strategies that will help the student overcome their phobia. The problem with math phobia, or any phobia, is that students will often not seek out strategies to help them because they feel it is not worth it because they cannot do math anyway. Research indicates that students with little or no math phobia both used and valued a wider variety of coping strategies than those students with higher levels of math phobia (Peskoff, 2000).

Researchers studied college students who were taking math classes to meet requirements for their degrees. The research suggested there are two types of coping strategies. One type is cognitive or math-dominated strategies, which focus on the learning of math content. These strategies focus on math content and assume that if the student understands it, there will be less anxiety towards it. The strategies in this category were; asking questions, doing extra homework and completing it on time so as to not fall further behind, allowing extra study time, getting a tutor, and discussing problems with the instructor outside of class. (Taylor, & Brooks, 1984)

The other category of coping strategies focused on the psychological aspects of overcoming the phobia. These strategies included; peer support groups, counseling with a professional counselor, positive self talk, and relaxation activities including exercise, socializing and stress reduction training. (Taylor, & Brooks, 1984)

What students used to cope with their math phobia differed based on their level of anxiety. Students with a higher degree of math phobia tended to rely more on counselors and tutors. Of the strategies studied, these two were considered to be among the least helpful to

students. Students with low math phobia tended to rely on a wider variety including relaxation, peer support groups, asking questions, homework, self talk, extra study time, and instructor help.

Taylor and Brooks (1984) also found significant gender differences with how the strategies were used. Males tended to use physical activities or exercise, both of which fell under the relaxation strategies. This was more of an avoidance technique for males and one of the lower strategies for success in coping with math phobia. Females were more likely to take on extra homework and complete it on time so as to not fall behind and talked to the instructor if they do not understand the course material. Both of these strategies were identified as being among the most effective coping strategies.

In this study, the effectiveness of the strategies was rated by the students, math instructors, and counseling faculty. They identified homework, extra study time, asking questions, and seeking help from the instructor as most helpful. There were some significant differences, however. The math instructors and the counseling faculty rated tutors as more helpful but rated relaxation lower than students did. The researchers felt tutors were rated higher by instructors because faculty could only perceive the tutoring experience whereas students actually participated in tutoring.

Negative attitudes toward math or a math phobia can be changed by establishing a positive and supportive learning environment in the classroom. Strategies to achieve this include; using concrete manipulative materials to help bridge the gap between concrete learning and abstract thought, using a variety of teaching techniques, and addressing the student's personal attitudes toward math. (Taylor, & Brooks, 1984)

The anxiety associated with taking a math class can interfere with the learning of math. As mentioned earlier, anxiety appears in the working or short term portion of the brain, the same

area that is used to do math calculations. By including math with other subject, the level of anxiety is decrease and more learning can take place.

In a study done at Unity College, researchers noticed many incoming freshman expressed concern about having to take a math class but were looking forward to taking biology class. The researchers saw this as a concern because algebra skills are needed to be successful in biology and other science areas. To succeed in this field of study, students would need to be comfortable with math concepts (Arnet & Van Horn, 2009)

The researchers combined the classes into a learning community. Intermediate algebra was required for students needing remedial instruction in math and general biology was required courses for all first semester freshmen studying the sciences at the school. The question at stake was would students perform better in math and would they have a more positive attitude toward math if it was taught in conjunction with a science class?

After four years of offering the combination, researchers found a significant increase in the math grades of the students who took the classes in the learning community versus those who took the classes separately. Those in the learning community had an average grade point of 2.47 in the algebra classes. Those who took the class separately (control group) had a grade point average of 2.01. The control group also had a great variance. The learning community group variance was 0.92 where as the control group was 1.87. (Arnet & Van Horn, 2009)

A more significant difference was in the students' attitudes toward math. After completing the course, 75% of the students in the learning community said they had a positive attitude toward math compared with only 38% of students in the unlinked group. 100% of those in the learning community said that understanding math was important to achieving their current career goals while only 55% of the students in the control group felt math was important. 75%

of the students in the learning community felt math was important in life and that they felt comfortable taking more math classes as opposed to 52% of the control group.

When surveyed about their feelings about math, those in the control group had an overall negative feeling. Students stated math was boring and they felt that math had little to no connection to the sciences. Students in the learning community responded they learned how to apply math to the sciences and that it was important to their careers. The students also felt they could read scientific articles better after taking the learning community linked courses (Arnet & Van Horn, 2009)

Alternative teaching methods in working with individuals

One option to help students overcome math phobia is service learning. This method of teaching is used at all levels. It involves students assisting other students while meeting their own learning objectives. In math, this would involve a student assisting another student with math skills.

With service learning, there are three key elements to a successful program. 1) Exposure provides the student with exposure to another student struggling to learn the same skills. 2) The experience needs to meet a community need for it to be valuable to the student. 3) The students also need to have the time to provide reflection. This is necessary to gain the confidence needed to overcome math phobia. (Gray, 2004).

Students how have participated in a service learning experience have reported several benefits. They have a great motivation toward their own course involvement. There is a deeper understanding of the course content which provides for a general overall improvement to the learning process. They experiences enhanced critical thinking and problem-solving skills. There was an improvement in their reflective judgment, and they reported an enhanced sense of social

responsibility. All of this led to students being more interested in math classes. When students are involved and interested in the coursework, they will work harder. Service learning provides a way for students to be more involved with the course.

Many students and adults can do math problems when presented with pages of numbers and problems to do. Teachers in New Zealand found students were able to do problems that were part of a worksheet but when the same problem was posed as a word problem, anxiety increased and they were unable to interpret it mathematically (Gray, 2005). Researchers noted that if math is presented in more real world examples, students could learn the skills and relate it to everyday life. By making math part of everyday life and not an isolated activity, some of the anxiety may be relieved. Dr. Baritompa from Canterbury University uses barn dance to teach math. "The patterns of the dance -- join up hands and circle left; take four steps in and four steps back, are geometric, symmetric, repetitive cyclic movements. These ideas are the stuff of mathematics" (Gray, 2004).

The use of technology adds another level of learning, particularly for kinesthetic learners, when combined it with the textbook and the presentation in the class. It offers a way for students to practice skills in a non-treating, repetitive manner. With practice activities online, students may repeat skills over and over until the skill is master. In a correctly developed system, the numbers would change for each attempt. Because it is online, there is an increased level of privacy. Adults are more sensitive to revealing their level of knowledge, or lack of knowledge. With technology, the instructor is the only one who needs to know how long or how many attempts were made to master the skill (Marikyn, 2009).

Summary

Math phobia is a debilitating condition for many adults in the United States. It develops, in most cases, during early elementary years of family and peer influences and the methods used to teach math. While math phobia can be debilitating, the good news it is that it is not a permanent condition.

Research indicates phobia or anxiety manifests in the brain in the working or short term memory. This portion of the brain is also used for doing math calculations causing a conflict. There is less working memory for the brain to process math. Any anxiety would have the same effect. Test anxiety is a common form of anxiety for all students and testing is the most common method of assessing a student's ability used in schools.

Traditional teaching methods for math also add to the anxiety level. Learners with a preference toward audio learning will do better with traditional methods. The visual and kinesthetic learner is left behind creating anxiety toward math.

Chapter Three: Conclusions and Recommendations

Because math phobia is so pervasive in American society, teachers working with adults need to be cognizant of how math is taught to provide students with tools to gain the skills needed. The anxiety is always going to be there, but teachers can help students to move past it. The existing literature on math phobia and anxiety leads to the following conclusions.

Because anxiety uses the same part of the brain that is needed to do math, math skills can be increased by help students reduce the anxiety. In the classroom, teachers must create a positive classroom environment to foster learning instead of squelching it. In formal learning situations, many time the first thing that is done is assessment testing. While assessment testing in necessary, students would be better served by waiting to do testing until they have become more comfortable in the classroom and have less anxiety about the situation. The assessment results would be more accurate and based on the actual abilities on not on the interference of anxiety.

Adults use math every, even if they do not realize it. A person working in an insurance office writing policies said she was very poor at math. It was pointed out to her that she uses math every day to calculate the policies she is writing. Her response was "that is not math!" Adults have the opinion that math is only what is done in the formal classroom. Identifying ways they use math in their everyday lives will help reduce the anxiety around having to do math.

Math instruction needs to focus more on real world application as opposed to "skill and drill" methods of instruction. In formal instruction, combining math with a science class is an example that has shown much success. In less formal settings, instructors need to identify other ways to teach math. For example, deciding how much concrete is needed to complete a patio as

an example of how to figure out area and volume. Tripling a cooking recipe is an example that can be used for adding and multiplying fractions. In essence, using more story problems instead of the "skill and drill" exercises will help students have a better understanding of the math and how it relates to their lives. This will help students focus more on the process and less on the answers. The research shows that understanding the process is more important to mastering the logic needed than getting to the right answer.

In smaller groups, problems can be focused on the interests of the person. If a student is interested in cars, math problems can focus around the calculations needed to repair a car. A person working on a real estate license could focus on the calculations needed to understand a mortgage. By focusing on their interests, the anxiety will be lowered leaving more room in working memory to do the math.

Students will also benefit from working together in peer study groups. By helping each other, they will be growing their own understanding of the process and focus less on their anxiety. Recently, a student who was working on passing the G.E.D. math test for about three years was partnered with a student who was new to the class. Both were the same basic level. The first student had been practicing these skills for a longer time. The results of this partnership helped both students work through their math phobia. The first student gained confidence in her abilities as she was able to explain the process to the other student. The second student did not feel as intimidated by studying math as an adult because there was another adult there studying the same things. She knew she was not alone.

Technology may also be used to help with instruction and reduce the phobia. By combining face-to-face instruction with online instructions, students have the benefit of learning by more than one teaching method. Online sessions that are properly prepared will allow the

student to repeat activities until the skill is mastered. Each repeat would change the numbers used so it is not simply redoing the same problem but repeating the process.

Use of "smart pens" could help with math instruction as well. These pens record all strokes taken. The information is then uploaded into a computer to be played back later. The benefit is the student can do the problem in class with the teacher there. Both kinesthetic and auditory learning styles are addressed this way. Once it is loaded into the computer, the student can later view what he/she did to complete the problem. This would address the visual learning style.

Online peer support groups are helpful as well. Adults are more willing to discuss their issues online than in person. Discussions about their concerns will help overcome the anxiety of taking a math class.

When working with adults with math phobia, the teacher's focus should not be on teaching the skills but rather helping the students gain the confidence to do math. With increased confidence, the anxiety will be lowered and more working memory will be freed to do math. By ensuring students have small successes along the way, the anxiety levels will slowly decrease and will develop into a positive spiral of math success. Math phobia is not a permanent condition. By providing students with the confidence needed to do math, the skills will follow.

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