Elementary Teachers’ Mathematics Anxiety and its Unintentional Transmission

Norma A. Martinez

University of Texas at El Paso

Master in Education-Instructional Specialist

Mathematics

**Abstract**

Mathematical anxiety has been a topic of high importance because many students have difficulty in this subject. Although students are having mathematical anxiety this could be a result of teachers’ own mathematical anxiety that is being consciously or unconsciously transmitted to students. In the following study twenty elementary teachers from a school district in El Paso, Texas will be selected by using a stratified random sampling plan that targeted at each elementary grade for class size, teaching level and mathematical content which are my variables of interest. The population was 90% Hispanic, 70% female, mainly of Mexican-American descendent. Studies show that many teachers pick elementary education for degrees in order to avoid mathematics.

*Key words:* Math anxiety, transmission, achievement, k-5, and perception, elementary teachers.

**Introduction**

Action research has provided me with the opportunity to engage in the examination of math anxiety, enabling me to report the effects of problem-limitation mathematics teaching on student transfer of solving-limitation skills and low retention of basic math facts and concepts. In this project, I have been studying the effects of unintentional transmission of math anxiety and the multiple diffusion manners from teachers to students. The motivation for this study came from my desire to help students to modify their perception about mathematics. I have noticed among elementary teachers that some of them decided to have a degree in elementary education because of their fear toward mathematics. I decided to ask several elementary teachers about their reasons to choose this career. Most of them admitted they tried to stay away from complicated mathematical applications.

As graduate students, we discussed the importance of elementary teachers in the foundation and perception of mathematics for students. Students who are surrounded by confident teachers, that are excited and positive about their role in the students’ learning process, will exhibit fewer symptoms of math anxiety than students whose teachers are anxious, uncomfortable, and negative about teaching mathematics. Elementary educators teach what they understand. However, when they do not thoroughly understand a concept they move on to the next concept to ease their tension and pressure in math classes.

Mathematics fear can limit teachers to make generalizations that will be necessary for the students’ connections among many independent mathematical concepts. This anxiety has the ability to cause low self-confidence, instigate fear of failure and cause pessimistic attitudes toward mathematics learning. Mathematics anxiety is usually, referred to feelings of tension, mental freezing and helplessness in an individual when required to perform mathematically (Richardson & Suinn, 1972). Moreover, mathematical anxiety can take multiple forms such as worry, fear, and dislike (Hart, 1989). By lowering the level of math anxiety, teachers will increase their confidence to work mathematics in a more meaningful level and students will perceive and learn math in a friendlier environment. It is necessary to engage teachers and students in activities that make them aware about their mathematical anxiety, in this manner, they will be able to face their problem and find ways to overcome it.

**Statement of the Problem**

The purpose of this study is to investigate the effects of an unintentional transmission of math anxiety from teachers on their elementary students and how it impacts the student’s perception and retention of basic math concepts.

**Review of Related Literature**

One of the major concerns of educators and parents alike is the decline in student mathematical achievement, where the higher-level thinking skills and problem solving techniques are so necessary for success (Smith & Westhoff, 1992). Students decline in mathematics achievement, not only limit their selection of college majors and future careers, but also shadow them with negative feelings of guilt and shame (Richardson & Suinn, 1972). “The math anxious seriously handicap themselves in both their daily lives and job opportunities” (Morris, 1981, p. 413).

Trujillo & Hadfield (1999) stated that the more severe people’s mathematics anxiety is, the more limited their college major choices will be. Furthermore, Ashcraft (2002) declared “Highly math-anxious individuals are characterized by a strong tendency to avoid math, which ultimately undercuts their math competence and forecloses important career paths” (p. 181). Particularly, Wood (1988) suggested that teachers who own higher levels of math anxiety may unwillingly pass on these negative thoughts to their students.

Math anxiety seems to influence cognitive processing in a straightforward way. Working memory resources are compromised whenever the anxiety is aroused. Given the prevalence of working-memory-dependent processing in math, this predicts serious effects of math anxiety. It is easy to imagine how anxiety affects learning. Math anxiety leads to a global avoidance pattern. Students avoid taking math classes and avoid situations in which math will be necessary, including career paths. According to Turner et al. (2002), students with an unsupportive teacher avoid in-school behaviors (making eye contact with the teacher, going out-of-class help sessions).

Additionally, Brush (1981) found that teachers who suffer from math anxiety are more incline to revert to traditional teaching methods with emphasis on basic skills and overlooking other important mathematical concepts. Likewise, Haladyna, Shaughnessy, & Shaughnessy (1983) states that class instruction have more prevalent effect on a class of students than on the persons who put it together. Unfortunately, according to Kelly & Tomhave (1985), elementary education majors, on average, scored higher (230.0) on the Mathematics Anxiety Rating Scale (MARS) than any of the other groups. “Not only does it inhibit students from doing mathematics, it may cause the math anxious to become math avoiders” (Morris, 1981, p. 413). The effects to our students are too damaging to oversight them. What is evident is the fact that math anxiety can be unwillingly transmitted by the teacher resulting in a set of fears and limitations. Investigators must persistently look for ways to help children learn mathematics.

According to the National Research Council (1989) altering mathematics anxiety into mathematics confidence is essential not only because of the economic and professional benefits but also because of the psychological enrichment that individuals experience when they are successful in mathematics. Furthermore, the National Council of Teachers of Mathematics (NCTM, 2000) specifically declares “excellence in mathematics requires high expectations and strong support for all students” (p. 11). Also, all students have the right to learn math and feel confident in their math abilities, and teachers must strive to see that “mathematics can and will be learned by all students” (NCTM, 2009, p.13). As educators we must prepare all students to compete in a world that deeply depend on using mathematics assertively.

What is of true value is to become aware of the circumstances that can trigger math anxiety and collaborate with students in a sensitive, yet encouraging manner. This includes the development of positive attitudes in teachers. It is essential for teachers to be well-informed and passionate about the content area they are teaching.

Haladyna, et al. (1983) suggested as the most powerful causal determinants of attitude towards mathematics are the student’s teacher and their learning environment. According to Buhlman & Young (1982), mathematics anxiety experienced by teachers can easily be transmitted to their students if nothing is done about it.

**Research Questions**

Why is math anxiety affecting elementary school teachers not only in their instruction, but transmitting their fears to new generation’ of students? In what ways do elementary teachers transfer problem-solving-imitating skills to their teaching of mathematics?

**Methodology**

 I will use the QUAN-Qual model, also known as the explanatory sequential mixed methods design. First, quantitative data are collected, through the MARS and IAAS scales. This will be follow by the collection of qualitative data using content analysis of the teacher journals, observations and field notes.

 **Participants**

 The sample for this study will be selected from the total population of elementary school teachers from a school district in El Paso Texas. The population is 90% Hispanic, 70% female, mainly of Mexican-American descendent. Twenty teachers will be selected by using a stratified random sampling plan that controlled at each elementary grade for class size, teaching level and mathematical content which are my variables of interest.

The sample should reflect the representation of the five teaching levels in the school district. Stratified sampling will guarantee desired representation of relevant subgroups with in the sample. It can also will select equal sized (no proportional) samples from subgroups to compare the achievement of students from teachers with different levels of math anxiety. The students participating in this study will be select using cluster sampling. Since we want to study the math anxiety transmission in the classroom, once a teacher is drawn his/her students are selected too.

**Instrument**

**Quantitative data collection tools**. The Mathematics Anxiety Rating Scale (MARS) will be used as the measuring instrument. MARS has been demonstrated to be a reliable Likert-type test which explores math anxiety from three different dimensions. First, it is related to class activities. Second, it involves numerical anxiety, deals with situations that require number manipulation, financial decisions. Lastly, it is about Social Responsibility Anxiety (Rounds & Hendel, 1980; Resnik, Viehe & Segal, 1982). The ninety-eight-items in the self-assessment scale represent different everyday situations in which math anxiety may be produced. This instrument was selected over smaller scales because it has potential for deeper exploration of the dimensionality of math anxiety. In addition, cronbach’s alpha coefficient value of internal consistency for MARS reported by Richardson and Suinn (1992) was .97.

Likert-type scales are used for measuring attitudes toward uncountable concepts (i.e., Mathematics). The Likert-type scale statements used for MARS are: not at all, a little, a fair amount, much or very much. Participants must be clear that honesty and accuracy on this exercise are critical to uncover math anxiety. The participant marked from 1 point to 5 points for every item. The total sum of the ninety-eight items adds up to the total value for the instrument. The range of values goes from 98 through 490 (Richardson and Suinn, 1972). Elementary teachers will answer to the whole 98 item scale while the participant students will answer only 30 items. Examples for the teachers’ MARS items are described in Appendix 3 and for students in Appendix 2. Each participant’s score is claimed to reflect the level of affection by math anxiety. Low scores means low math anxiety and high scores point out high math anxiety. According to Ashcraft (2002), “MARS… has very acceptable test-retest reliability (an individual who takes the MARS on different occasions generally receives similar scores)” (p.181).

The Inventory of Affective Aspects of Schooling (IAAS) will be used to appoint several aspects of teacher-student relations in the classroom interactions during mathematical instruction. The following interactions will be appointed: 1) Student Motivation (SM), 2) Teacher Quality (TQ), 3) Social-Psychological class climate (SP), 4) Student attitude toward mathematics (SAM). The origins of the items and scales are varied (Haladyna et al., 1983). For example, the attitude scale was adapted from Haladyna and Thomas (1979a & 1979b), which “has been found to be highly construct valid for reliably measuring attitude toward mathematics” (Haladyna et al., 1983, p.22). SP scales were created by selecting items from the Learning Environment Inventory and the Classroom Environment Scales (Anderson & Walberg, 1976; Moos & Trickett, 1974). Other items were adopted from the National Assessment of Educational Progress item collection. Sample items from each scale are listed in Appendix 1.

***Causal comparative design.*** The design in this study for the quantitative part will be pretest-posttest. This design is selected because it provides data to compare the levels of anxiety before the teachers consider fear and the implications that it can bring to their students.

**Qualitative data collection tools**. The teachers will be asked to write thirty 1000 words journals to record their learning struggles, successes and feelings about mathematics; they used specific prompts created to raise the usefulness of the obtained information. Example of the teachers’ journals topics are described in Appendix 4.

Unscheduled class observations during instruction were used to: 1) Observe teachers’ motivation through their enjoyment of teaching, their confidence to explain math concepts exhaustively and their confidence to manage the inquisitiveness of their students. 2) Observe student participants working mathematics and their attitudes among them and toward the teachers during instruction. 3) Observe class organization. Is the time well planned? Are the goals stated and reached by all the students? Is the class well-structured and organized? Does the teacher provide supporting materials to aid the students? 4) Record field notes were used to keep information throughout the study which included detail information about the participants’ responses and unexpected events.

Guba’s criteria will be used for ensuring the validity of qualitative research. The observers will prolong their participation at the study site to overcome distortions produced by their presence, and to get the opportunity to test their bias and perceptions. Their observations must be persistent to identify pervasive qualities as well as atypical characteristics. We will be using peer debriefing among the different observers. There will be member checks with the teachers before any final decision. The observational data must be detailed and descriptive. There will be established an audit trail with the math facilitator from the School district. The facilitator will have access to the written description of the processes and the original data.

The triangulation from all the qualitative data will be made during five different stages and finally discussed in group by the multiple observers, and myself. There will be five groups of four observers who will review and evaluate the observation notes gathered from each group, until all have discussed each group’s observations. Then all groups and myself will meet together and make a final discussion about the findings and conclusions.

**Procedures**

 Prior to the beginning of the 2013-2014 school year, before classes will be scheduled, 20 of the 450 elementary teachers from the school district will be drawn using stratified random sampling plan that controlled each elementary grade for class size, teaching level, and mathematical content which were our variables of interest.

Written permission to conduct the study will be obtained from district administrators and Institutional Research Boards (IRBs) office. Teachers will receive the MARS pretest to take home and complete during the first week of class. For the students, a test administrator specialized in MARS will visit the classrooms during the same week and administer the instrument. The teachers will be asked to leave the classrooms during the testing. Grades 1-4, the items will read to the students. At Grade 5 the MARS will be self-administered. Individual assistance will be offered to students who experience difficulty in reading items. Data will be eliminated for students who chose not to participate or who complete only a part of the inventory. All responses from the students will be kept anonymous to encourage honest responding and ensure confidentiality.

The measures and process for IAAS application will be similar to those taken during MARS administration; however it will take place during the second week of class and only administer to students.

The study is designed to last eight months beginning on the first day of class. The classrooms selected will be taught using their teachers’ regular method (to observe teachers’ motivation). Educators will work on their journals by writing their experiences during each week focusing on a given question. The study will include observations of teachers, of class interactions, class organization, and field notes. A detail time itinerary will not be handed to teachers to prevent the insertion of anxiety in the participants. Observers will be in the classroom without notifying the participants about their specific objective.

During the last week of class, in order to notice any changes in the participants’ math anxiety, the teachers will receive another copy of the MARS and ask to bring it back on the last day of class that week. Following the previous protocol from the pretest also will receive another copy of the instrument during the last week of class.

**Analysis of Data**

 The pretest MARS score will be subtracted from the posttest MARS score for each participant to disclose any change in the score. A negative difference meant that the participant anxiety was decreased by that score amount. A positive difference meant that the participant anxiety was increase by that score amount. A triangulation of the individuals’ anxiety will be done using the IAAS as reference.

 The qualitative measurements included informal observations in the methods, class interactions, class management, field notes, and teachers’ essays. All qualitative information was transcribed and analyzed using NVIVO software. Once individual nodes were determined, general codes were revealed.

We triangulate our qualitative and quantitative data by looking at the classroom first as a whole including the teacher and then transposing the main characteristics of each individual cluster as a coding in the overall view of the participants to create a reliable pattern of conduct for our research.

References

Anderson, G. &Walberg, H. (1976). *The assessment of learning environments: A Manual for the Learning Environment inventory and the my class inventory.* Chicago: University of Illinois.

Ashcraft, M. (2002). Math Anxiety: Personal, Educational, and Cognitive Consequences. *Current Directions in Psychological Science,* 11(5), pp. 181-185. Sage Publications, Inc.

Brush, L. (1981). Some Thoughts for Teachers on Mathematical Anxiety. *Arithmetic Teacher*, 29(4), pp. 37-39.

Buhlman, B. & Young, D. (1982). On the Transmission of Mathematics Anxiety. *Arithmetic Teacher,* 30(3), pp. 55-56.

Haladyna, T., Shaughnessy, J. & Shaughnessy, J. M. (1983). A Causal Analysis of Attitude toward Mathematics. *Journal for Research in Mathematics Education,* 14(1), pp. 19-29. National Council of Teachers of Mathematics.

Haladyna, T. & Thomas, G. (1979a). The Affective Reporting System. *Journal of Educational Measurement,* 48, pp. 49-54.

Haladyna, T. & Thomas, G. (1979b). The Attitudes of Elementary School Children toward School and Subject Matters. *Journal of Experimental Education,* 48, pp. 18-23.

Hart, L (1989). *Describing the affective domain: Saying what we mean. In D. B. Mc Leod &V. M. Adams (eds.).* Affect and Mathematical Problem Solving: A new perspective. pp. 37-45. New York:Springer-Verlag

Kelly, W. & Tomhave, W. (1985). A Study of Math Anxiety/ Math Avoidance in Preservice Elementary Teachers. *National Council of Teachers of Mathematics,* 32(5), pp. 51-53.

Moos, R. & Trickett, E. (1974)*. Classroom Environment Scale: Manual and Form.* R. Palo Alto, Calif.: Consulting Psychologists Press.

Morris, J. (1981). Math Anxiety: Teaching to Avoid it. *The Mathematics Teacher,* 74(6), pp. 413-417. National Council of Teachers of Mathematics.

National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics.* Reston, VA.

National Council of Teachers of Mathematics (2009). *Focus in high school mathematics: Reasoning and sense making*. Reston, VA

Resnick, H., Viehe, J., & Segal, S. (1982). Is Math Anxiety a Local Phenomenon? A Study of Prevalence and Dimensionality. *Journal of Counseling Psychology*, 29, pp. 39-47

Richardson, F & Suinn, M. (1972). The Mathematics Anxiety Rating Scale: Psychometric Data. *Journal of Counseling Psychology*. 19(6), pp. 551-554. American Psychological Association.

Rounds, J. & Hendel, D. (1980). Measurement and Dimensionality of Mathematics Anxiety. *Journal of Counseling Psychology,* 27, pp. 138-149

Smith, E. & Westhoff, G. (1992). The Taliesin Project: Multidisciplinary Education and Multimedia. *Educational Technology,* 32(1), pp. 15-23.

Trujillo, K. & Hadfield, O. (1999).Tracing the roots of Mathematics Anxiety through in-depth Interviews with preservice elementary teachers. *College Student Journal*. 33(2), pp. 219-233.

Turner, J., Midgley, C., Meye, D., Gheen, M.,- Anderman, E., Knag, Y., & Patrick H. (2002). The Classroom Environment and Students’ Reports of Avoidance Strategies in Mathematics: A multimethod study. *Journal of Education Psychology*. 94, pp. 88-106.

Wood, E. (1988). Math Anxiety and Elementary Teachers: What does Research Tell Us?.*For the learning of* Mathematics, 8(1), pp. 8-13.FLM Publishing Association

**Appendix 1**

**Sample Items for the Scales**

**====================================================================**

**Scale Sample item**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

*Student Motivation (SM)*

 Academic self-concept I believe that I am a successful student

 Importance of Mathematics Math is a valuable asset for my future

 Fatalism I am not the type to do good in math.

*Teacher Quality (TQ)*

 Enthusiasm My teacher likes mathematics

 Respect My teacher knows her math very well

 Commitment to help students learn My teacher appreciates our work

 Providing individual attention My teacher does not matter explaining 1-1

 Fairness My teacher is fair to everyone

 Praise and reinforcement My teacher recognize me when I my work is good

*Social-Psychological (SP)*

 Enjoyment of classmates How much do you like your classmates?

 Environment The students will not fear to explain a math problem in class

 Cliquishness There are small group of students who are always together

 Friction There is a group of students that interfere with class activities

*Student Attitude toward Mathematics (SAM)*

How do you feel \_\_\_\_\_\_

1. When it is time for math instruction?
2. During teachers’ math questioning?
3. When math class is over?
4. If you knew you would never go to math again?

**Appendix 2**

**Sample items for the scale**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Student MARS Test**

Not at all (1), A little (2), A fair amount (3), Much (4) or Very much (5)

1. I like doing math homework 1 2 3 4 5

2. When I hold a math textbook to study I start feeling stomach ache. 1 2 3 4 5

3. I cannot concentrate on anything before a math exam. 1 2 3 4 5

4. I am afraid of presenting the problems to the teacher which I can solve. 1 2 3 4 5

5. I can ask my teacher about a concept, which I did not understand well, after a math class. 1 2 3 4 5

6. I would rather learn a subject presented with numbers or graphics than with words. 1 2 3 4 5

7. The best parts of the other courses are the parts dealing with mathematics. 1 2 3 4 5

8. I get nervous when I learn that the next lesson is mathematics. 1 2 3 4 5

9. I do not like making calculations in everyday life. 1 2 3 4 5

10. I like to look through mathematics books. 1 2 3 4 5

**Appendix 3**

**Sample items for the scale**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Teacher MARS Test**

Not at all (1), A little (2), A fair amount (3), Much (4) or Very much (5)

1. If one of my friends is chosen for answering a question in math class,

 I feel happy for not being the chosen one. 1 2 3 4 5

3. I cannot ask any question about what I did not understand in math class. 1 2 3 4 5

4. I want to be the treasurer of the school clubs which I participate in. 1 2 3 4 5

5. I can reject helping a child with his homework, because I am afraid of

 facing a question which I cannot solve. 1 2 3 4 5

6. I am afraid of taking a math pop-quiz. 1 2 3 4 5

7. I come to the first day of math classes with hope every year. 1 2 3 4 5

8. I cannot study well for math exams because I worry about my grade. 1 2 3 4 5

9. When I open my math book and look at the pages, I fear I will fail the course. 1 2 3 4 5

10. I can ask my teacher about a concept, which I did not understand well, after a math class. 1 2 3 4 5

**Appendix 4**

**Sample item for the surveys**

1. What do you perceive are the favorite things in math for your students?
2. What do you perceive are the least favorite things in math for your students?
3. How do you perceive when your students do not understand the class content?
4. What do you perceive as the most effective teaching strategy? Why?
5. Can you teach math effectively?
6. Can you turn children’s interest on to math?
7. What supporting materials do you use to reinforce concepts during math class? Why?
8. What sources do you find useful to get information about current issues in math education? Why?
9. How do you describe math anxiety in your students?
10. How do you cope with anxiety? Explain
11. Do you ever think about your students math needs when you are at home? Explain
12. How do you feel about teaching math compared to last year? (if less than a year of teaching experience, compared to your first day of teaching) why?
13. Do you feel any different towards math now than you did at the beginning of your teaching job?
14. What skills are necessary to teach math? Explain
15. Do you know procedures to effectively teach math concepts? Describe
16. Are you able to monitor hands-on math? Describe
17. Are willing to teach 1-1 math to an inquisitive student? Explain
18. Are you comfortable while being observed teaching math? Explain
19. Are you continually looking for better ways to teach math? Explain
20. Do you go beyond your curriculum during math instruction? Describe