

# **A Teacher's Quick Guide to Understanding Mathematics Anxiety**

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**Abstract:** A brief literature review provides insight for a teacher to understand mathematics anxiety. Components of the literature review include descriptions, symptoms, and origins of mathematics anxiety. In addition, teaching methods to assist students in reducing mathematics anxiety are discussed.

Every mathematics teacher has observed a student who is the victim of mathematics anxiety: the student who squirms when asked to solve a word problem; the student who avoids eye contact when the teacher asks for volunteers to solve a problem on the blackboard; or the student who freezes while working a test problem similar to one the student explained in class the day before. All are examples of reactions suffered by victims of mathematics anxiety. Typically, mathematics teachers appreciate the beauty of mathematics and embrace the challenge of the subject, but some mathematics teachers have difficulty understanding the math-anxious student. Therefore, in an effort to provide teachers with a basic understanding of the math-anxious student, this paper provides descriptions, origins, and symptoms of mathematics anxiety along with effective teaching methods for reducing mathematics anxiety.

## **Descriptions of Mathematics Anxiety**

There are numerous descriptions of mathematics anxiety and each “victim” may have his own description. Tobias and Weissbrod (1980) described math anxiety as “the panic, helplessness, paralysis and mental disorganization that arises among some people when they are

required to solve a mathematical problem” (p. 65). Tobias (1978), who wrote *Overcoming Math Anxiety*, is often referred to as a pioneer in the study of mathematics anxiety. Psychologists Richardson and Suinn (1972), who developed the first instrument designed specifically to measure mathematics anxiety – Mathematics Anxiety Rating Scale (MARS), defined math anxiety as the “feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of ordinary life and academic situations” (p. 551). While these two definitions involve psychological and physiological characteristics, others explain mathematics anxiety specifically as an emotion. Spicer (2004) stated that mathematics anxiety is “an emotion that blocks a person’s reasoning ability when confronted with a mathematical situation” (p. 1). Freedman (2003) defined math anxiety as “an emotional reaction to mathematics based on a past unpleasant experience which harms future learning” (p. 1).

Another description portrays math anxiety as a gorge separating the “concrete” from the “abstract” (Reys, Lindquist, Lambdin, and Smith, 2007). The “concrete” is characterized by modeling, manipulating, and communicating while the “abstract” is characterized by generalizing, representing, symbolizing, and communicating. There are a number of problematic behaviors listed as existing in that gorge – dislike of math, apathy, lack of confidence, poor motivation, weak performance on math tests, behavior problems in class, and confusion. These behaviors are best observed within the realm of teaching mathematics.

### Symptoms of Mathematics Anxiety

Victims experience mathematics anxiety in myriad ways that range from an uneasy feeling to difficulty breathing while attempting to complete mathematical tasks (Smith, 1997). There are physiological symptoms as well as psychological symptoms. Increased heart rate,

clammy hands, upset stomach, and lightheadedness are examples of physiological symptoms (Cemen, 1987; Kitchens, 1995; Posamentier & Stepelman, 1990). Feelings of helplessness, worry, disgrace, and not being able to cope are examples of psychological symptoms (Cemen, 1987; Posamentier & Stepelman, 1990). Tobias (1978) wrote that the first thing people recall about mathematical failure is that it “felt like sudden death” (p. 44).

### Origins of Mathematics Anxiety

Research indicates that the origin of math anxiety is complex. Norwood (1994) states that “it is the result of different factors” (p. 248). Origins point to personality, intellectual, and environmental factors (Hadfield & McNeil, 1994). Having low self-esteem, being timid asking questions, and having such ideas as mathematics being a male-dominated field are some personality factors (Cemen, 1987; Gutbezahl, 1995; Levine, 1995; Miller & Mitchell, 1994). Intellectual factors include poor attitude, low self-confidence, and not believing that mathematics has a purpose (Cemen, 1987; Miller & Mitchell, 1994). Damaging classroom events, indifferent teachers, and demanding parents are examples of environmental factors (Dossel, 1993; Tobias, 1990).

Tobias (1978) discussed other various possible origins of mathematics anxiety including lack of adequate mathematics preparation, confusion about the language of mathematics, distrust of intuition, and the idea of mathematics as an “exact science.” Another idea described by Tobias (1978), the “dropped stitch,” refers to situations such as a student being absent for an extended period of time and missing the initial discussion of a key mathematical concept like the basic meaning of a fraction.

Mathematics anxiety can also originate from instructional situations. Fiore (1999) believes that “teachers and the teaching of mathematics are known to be the roots of mathematics anxiety” (p. 403). In that the learning of mathematics is a result of the teaching of mathematics, mathematics anxiety may be a result of some mathematics teaching (Harper & Daane, 1998; Lazarus, 1974; Newstead, 1998; Peterson & Fennema, 1985; Skemp, 1979). In *Arithmetic Teacher*, Greenwood (1984) wrote that he thought that the primary origin of mathematics anxiety was the teaching methods used in teaching basic math concepts. These teaching methods include assigning the same homework problems for all students, following the textbook exactly, allowing only one method for solving a problem, and assigning mathematics as punishment (Oberlin, 1982). Mathematics anxiety origins include teacher-related behaviors such as “intimidating comments, inability to explain concepts, lack of enthusiasm for subject matter, and lack of patience with students” (Plaisance, 2007, p. 110).

### Teaching Methods for Reducing Mathematics Anxiety

One should recall the description of math anxiety as the gorge separating the “concrete from the “abstract” (Reys et al., 2007). Mathematics teachers spend their lives taking students on the journey from the concrete to the abstract and some do not allow students time to “traverse” the gorge. Teachers should promote conceptual understanding as opposed to direct memorization. Reys et al., (2007) state that students “attempting to memorize mathematics without understanding are likely to fall into this ‘anxiety gorge’” (p. 18). Time spent traversing the gorge should be used to model representation that allow students to learn how to “represent” ideas in simplistic ways such as drawings and word equations before introducing the symbolic representation. Mathematics teachers should guide their students over that gorge by assisting

them in making connections between the concrete and the abstract to promote conceptual understanding, to increase learning success, and to alleviate symptoms of mathematics anxiety.

The National Council of Teaching of Mathematics (NCTM) (1995a) recommends a variety of strategies for teachers to implement in order to reduce and/or prevent mathematics anxiety of students. Many of these recommendations are strategies that teachers already use in their classrooms because they are considered best teaching practices. NCTM recommends the following:

- Accommodate different styles of learning;
- Create a variety of testing environments;
- Design positive experiences in mathematics classes;
- Emphasize that mathematical ability is not a measure of self-worth;
- Emphasize that everyone makes mistakes in mathematics;
- Make mathematics relevant to life;
- Allow students input into their own evaluations;
- Allow for different social approaches to learning mathematics;
- Encourage original thinking instead of rote memorization;
- Characterize mathematics as a human endeavor.

It should be noted that when strategies such as these are used to prevent and/or reduce math anxiety, students' mathematics anxiety usually decreases (Hembree, 1990). Prevention of math anxiety begins with instruction that creates positive self-concepts (Desper, 1988). Reys et al., (2007) stated that "the best strategy is prevention, and the second best is early detection" (p. 19). In addition to Reys' suggestions, teachers should implement the above suggested strategies for reducing mathematics anxiety.

## Conclusion

Teachers should be aware of their students' needs and make every attempt to address as many needs as possible. If students display any symptoms of mathematics anxiety, then remember the recommendations indicated by research. One should not forget that while many believe teachers are the "root" of mathematics anxiety, research indicates that mathematics anxiety reduces as a result of various teacher-related behaviors including strategies suggested by NCTM.

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*Dr. DesLey V. Plaisance is currently an Assistant Professor in the Department of Mathematics and Computer Science at Nicholls State University and serves as Coordinator of Graduate Studies in Mathematics. She teaches undergraduate mathematics courses for education majors and graduate courses in mathematics curriculum/research. Plaisance's primary research focus is mathematics anxiety of preservice elementary education teachers.*

Quick Guide to Challenges and Teaching Tips. Challenges. Teaching Tips. Maths anxiety is a feeling of tension, apprehension and/or fear that interferes with maths performance. It can present at any stage from early years to adulthood (Ashcraft 2002). The higher a student's maths anxiety, the lower their maths learning, mastery and motivation. It is understandable that students who are not competent in maths are likely to be. Fig.1 Maths Anxiety. The "teacher" needs an understanding of what the student can achieve alone as well as what they might achieve with help. Then, through guidance, activities, interaction and questions, the student moves from being unable to do a task to being able to do it. 15. A Guide to Tackling Maths Anxiety. Building more confident and resilient learners, teachers and communities. Insights from the Power of Maths Roundtable. Mathematics anxiety has been defined as: A feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in ordinary life and academic situations. Richardson and Suinn (1972)2. It is a negative emotional reaction to mathematics that acts as an "emotional handbrake" and holds up progress in maths. A teacher's perspective: West Lakes Academy Research Project. Rob Brown, a maths teacher at West Lakes Academy in Cumbria, shares the impact pupil and teacher questionnaires made to understanding maths anxiety in his school. Mathematics anxiety has been continually found to correlate negatively with students' mathematics performance, with correlations ranging from -.11 to -.36 (Ho et al., 2000). Hembree (1990) analysed 151 relevant studies and reported an average correlation of -.34 for school students whereas Ma (1999)'s meta-analysis of 26 studies revealed a correlation of -.27. Similar results were also reported in Asia, like in China, Taiwan, and Singapore. Teachers who complained of insufficient instructional time might resort to preparing their students for assessment rather than for understanding. This creates more tension when students encounter unconventional problems or when the mathematics becomes more advanced. - mathematics anxiety: what a teacher can do to help students with this problem. An Honors Thesis (ID 499) by. Carina Kay Flora Snyder. As these definitions point out, mathematics anxiety is an emotional response to anything mathematical from the everyday task of balancing a checkbook to the more technical task of finding the area under a curve. Such emotional responses might include a fear of or a feeling of inadequacy when dealing with mathematics. Williams (1988) indicated that the lack of understanding of mathematics which many students possess leads to failure in later classes, and this in turn leads to feelings of helplessness. These feelings of helplessness soon develop into mathematics anxiety.

Understanding Mathematics Anxiety. Investigating the experiences of UK primary and secondary school students. Report authors: Emma Carey<sup>1</sup>. Mathematics anxiety describes feelings of apprehension, tension or discomfort experienced by many individuals when performing mathematics or in a mathematical context (Richardson & Suinn, 1972). It has been associated with cognitive difficulties performing mathematical tasks, potentially because anxiety interferes with our ability to hold and manipulate information in mind (working memory), but is predominantly an emotional problem (Ashcraft & Krause, 2007). Quick Guide to Challenges and Teaching Tips. Challenges. Teaching Tips. Maths anxiety is a feeling of tension, apprehension and/or fear that interferes with maths performance. It can present at any stage from early years to adulthood (Ashcraft 2002). The higher a student's maths anxiety, the lower their maths learning, mastery and motivation. It is understandable that students who are not competent in maths are likely to be. Fig.1 Maths Anxiety. The "teacher" needs an understanding of what the student can achieve alone as well as what they might achieve with help. Then, through guidance, activities, interaction and questions, the student moves from being unable to do a task to being able to do it. 15. mathematical understanding, but there are interactions towards the mathematics anxiety. It indicates that the collaborative teaching model and the student's prior knowledge do not simultaneously impact on the mathematics understanding but the mathematics anxiety. 1. Introduction. Mathematical understanding is one of the cognitive aspects that need to be developed in mathematics. The two teachers are the facilitators, moving around the classroom to guide students when the lesson starts, enabling students to avoid the nervousness and fear of asking questions. This setting overcomes the possible problems that arise better. Concept "Math anxiety". Mathematics anxiety can be defined as feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of societal life and academic situations. Math anxiety indicates psychologically a feeling of tension (Richardson & Suinn, 1972) which interferes with learning and performance. [19] Plaisance, D.V. (2009): A teacher's quick guide to understanding mathematics anxiety, Louisiana Association of teachers of mathematics journal, 6(1). [20] Jackson E. (2008): Mathematics anxiety in student teachers, Practitioner research in higher education 2(1), 36-42. A teacher's guide. This guide is intended to support teachers' ongoing efforts in building students' knowledge and skills in mathematics. Understanding how numbers work is foundational to all aspects of mathematics. As students progress through the grades, they learn about different types of numbers and how those numbers behave when operations are applied to them. Recognizing and understanding number properties is foundational to arithmetic and algebra. 1. See Ministry of Education, A Guide to Effective Instruction in Mathematics, Kindergarten to Grade 6. Volume 5: Teaching Basic Facts and Multidigit Computations, Appendix 10-2, n.d., p. 69. 4. CATEGORY\* Working with Numbers.