

DECREASING MATH ANXIETY IN COLLEGE STUDENTS

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This paper examines the phenomenon of mathematics anxiety in contemporary college and university students. Forms of math anxiety range from moderate test anxiety to extreme anxiety including physiological symptoms such as nausea. For each of several types of math anxiety, one or more case studies is analyzed. Selected strategies for coping with math anxiety are included. Some students' own ideas are presented along with analysis from leading experts in the subject of math anxiety.

Math anxiety is an extremely common phenomenon among college and university students today. Steven G. Krantz describes an extreme form of this syndrome: "Math anxiety is an inability by an otherwise intelligent person to cope with quantification, and more generally, mathematics. Frequently the outward symptoms of math anxiety are physiological rather than psychological. When confronted with a math problem, the sufferer has sweaty palms, is nauseous, has heart palpitations, and experiences paralysis of thought ... this quick description does not begin to describe the torment ..." (Krantz, 1999). Of course, most college students don't experience this level of terror. Many do, however, suffer from the problem in some form or other. Approximately 85% of this author's students who take introductory mathematics classes claim to feel at least mild math anxiety, according to surveys administered during the first week of the semester.

Most teachers of mathematics would agree that math anxiety stems primarily from students' fears of failure and feeling of inadequacy. In most cases, math anxiety

is not extreme or overwhelming, yet it continues to haunt most students throughout their mathematical careers. Although no classification can be entirely precise, this paper will attempt to classify and analyze different classes of students affected by the syndrome.

Perhaps the mildest variation of math anxiety is moderate test anxiety. Very frequently students report that they understand their mathematics class quite well during ordinary classes and while doing homework assignments, but panic and fail to realize their potential during exams. In one student's words,

"I feel confident when the professor is reviewing ... I think to myself, 'I got this stuff, this is easy'. But when it comes to me taking the test, I somehow forget most of the concepts that I had known so well. This causes me to panic".

Certainly the most common form of math anxiety is the moderate and intermittent variety found in a student who has mixed feelings towards the subject. A clas-

sic case is "Jason," who writes:

"Throughout my mathematics experiences I have come to find that I have math anxiety. What I mean by this is that I am not thrilled about math and quite frankly it frustrates me. Don't get me wrong. I like math when I get the right answers but when I don't it's another story. Math is one of the most important things you can learn in life but the hard part is learning it and remembering it. All the formulas and methods to do different kinds of problems are mind boggling. I would have to say that the most frustrating thing about math is doing a long problem. A math problem that has many equations and answers which takes a long time such as a word problem. The worst is when you do everything right except one little part in the beginning and it messes up the whole problem."

Often math anxiety starts at a young age. If a student has a single insensitive math teacher, that can create a recurring anxiety problem which may be difficult to overcome. Jessica is typical of a large number of students, in that she is haunted by memories of one particular mathematics class that she took long ago. Jessica describes her experience:

"My math anxiety started because of a teacher that I had for math in the third grade. We were learning our times tables, and she didn't have any sympathy for the kids that were a little slower than the others. We would play a flash card game in

front of the class, and if you got it wrong, she made you look like an idiot. So my anxiety comes from being afraid of being wrong in front of a group, and looking stupid."

Indeed, there are countless students who recount with horror some previous experience with a teacher they perceived to be incredibly incompetent, or even malicious. "I took Algebra II my sophomore year in high school and had a bad teacher. She only taught to the smartest students in the class who didn't need that much attention and she didn't really explain the subject matter." "In ninth grade I had a teacher who would always pick on me to answer questions, that made me extremely nervous". "I didn't understand the [geometry] concepts and the teacher wasn't very understanding. I remember the teacher yelling at me because I didn't understand."

Of course many of the "bad math teachers" of which college math students speak are fully competent professionals. To find a scapegoat for one's problems is human nature, and mathematics teachers are convenient targets for attack. In fact, however, many mathematics teachers at the K-12 level are to blame for their students' poor comprehension. Frequently computational skills, which are easy to teach, are taught at the expense of mathematical concepts. Occasionally students realize this deficiency in their preparation. "A lot of teachers show you how to do something, but leave out the why. Sometimes if you know the why, it is easier to come up with the how," one of them writes.

In fact, mathematics education experts

generally agree with this student's assessment. John Allen Paulos, in his best-selling book *Innumeracy*, writes:

"Some of the blame for the generally poor instruction in elementary schools must ultimately lie with teachers who aren't sufficiently capable, and who often have too little interest in or appreciation of mathematics. In turn, some of the blame for that lies, I think, with schools of education in colleges and universities which place little or no emphasis on mathematics in their teacher training courses" (Paulos, 1988).

An extremely common occurrence is the following: a student has a superficial understanding of mathematics limited to computational skills, with little conceptual understanding and hence no mental framework within which to organize his/her knowledge. As a result, this type of student forgets what he or she learns very quickly, and experiences chronic frustration. Dustin's experience is typical:

"Ever since I was in junior high I never really liked math that much. It wasn't the subject itself that I didn't like but more the fact that I had a hard time remembering everything. It just seemed like whenever I finished a chapter, I would forget how to do what we just learned."

There is no simple solution to the problem of pervasive mathematical illiteracy amongst college students, and neither is there any simple solution to the problem of math anxiety. It is, however, possible to

attack the problem in many ways. Some of the best solutions are simple and obvious to students who take time to contemplate the issues.

Naturally, both student and teacher should have a proactive attitude towards mathematics education. As one student puts it,

"I believe that the student's responsibility is to try as hard as possible and also to respect other classmates as well as the teacher. And I also believe that it is the student's responsibility to seek help after class when he/she is confused. As for the teacher's responsibilities, I believe it is the teacher's responsibility to focus on every student's learning, not just a select few. And I also believe that if you want to be a successful teacher, you have to have patience."

It is particularly important for students to ask questions. Juan explains:

"Students can ... help the situation by asking questions instead of getting anxious and aggravated. This also helps out in class discussion and might benefit another student who wanted to ask a question but didn't. It's plain and simple. If everyone works together in the classroom, math anxiety can be lessened immensely."

Students must direct their energies towards improving their mathematical abilities and solving problems, not at scapegoats. When students have difficulty with mathematics, they may feel

helpless or frustrated. But to merely blame their textbook or their teacher is counter-productive. If a student cannot get adequate assistance from one source, say, the textbook, then he or she must seek either keep trying or find a second source of aid. Kogelman and Warren advise their students:

"You will feel much better and work more productively when you channel your energies into increased assertiveness in asking questions, and in not allowing people to play any math games on you." (Kogelman & Warren, 1978)

Similarly, students should not fall prey to negative racial or gender stereotypes that may lead them to believe they cannot do well in mathematics. For example, as Zaslavsky writes,

"The belief that females have an unborn, unalterable inferiority when it comes to doing math is among the many myths that cause them to shun mathematics" (Zaslavsky, 1994).

Countless studies, however, have shown that males and females are equal in terms of intrinsic mathematical ability. It is absurd for any individual to think for even for an instant that their race or gender makes them mathematically incompetent. Nonetheless, it may be helpful for some students to be reminded of this fact, or to remind themselves.

Perhaps the most important counter-anxiety technique is simply to keep a positive attitude.

"Let your mind dwell on success", as Ruedy tells her students (Ruedy, 1990).

Nearly every student has had some positive experience with mathematics.

Thinking about this happy experience, and especially writing about it, reminds an individual that he or she has the potential to be successful in mathematics, and serves as an inspiration. Each semester this author asks each student in each introductory class to describe at least one such experience in writing; this teaching technique has proven quite successful. It is imperative that a student be reminded also of his or her continuing accomplishments in mathematics, as a source of inspiration. If necessary, the student can remind him or herself, but ideally, external validation should be provided as well.

Mathematics anxiety is a complex and subtle problem with no simple solution. Paradoxically, however, the most effective coping strategies are natural and direct. Students need to acknowledge their mathematical difficulties and formulate a plan to overcome them, including seeking appropriate assistance when necessary. With patience on the part of the student and the instructor, math anxiety can very likely be reduced.

References:

- Kogelman, S. & Warren, J. (1978). *Mind Over Math*. New York: McGraw Hill.
- Krantz, S.G. (1999). *How To Teach Mathematics*. Providence: American Mathematical Society.
- Nirenberg, S. & Ruedy, E. (1990). *Where Do I Put The Decimal Point: How To Conquer Math Anxiety and Let Numbers Work For You*. New York: Avon Books.
- Paulos, J.A. (1988). *Innumeracy*. New York: Hill and Wang.
- Zaslavsky, C. (1994). *Fear of Math*. New Brunswick, N.J.: Rutgers Univ. Press.