

Are Your Students Scared to Death of Mathematics?

Here's How to Help

By Pauline David

The Little Oxford Dictionary defines *phobia* as fear or aversion. Psychology textbooks describe it as an abnormal fear. We hear of claustrophobia, acrophobia, nyctophobia, and anthropophobia. Is there such a thing as math phobia?

To be convinced that this fear really exists, one needs only to teach mathematics, talk to students at any level of education, or listen to comments made by doctoral students who have to take a class in probability and statistics. Call it what you will—fear, math anxiety, math avoidance, or phobia—it does exist, and teachers encounter students with such fears almost every day in every classroom.

Sheila Tobias, in her book *Overcoming Math Anxiety*, has discussed the symptoms of this problem. She observed that the first thing people remembered about failing at math was that it felt like sudden death. Whether it happened while learning word problems in sixth grade, solving

Mrs. David has taught mathematics for 35 years at all levels from elementary through college. She currently serves as Assistant Professor, Department of Mathematical Science, Columbia Union College, Takoma Park, Maryland.



equations in high school, or confronting failure in the college calculus class, it was sudden and very frightening.

A Struggle for Classroom Survival

Why do some children and even grownups have such a strong fear of math? After observing children in the classroom for many years, I believe that in some ways math phobia relates to students' struggles to survive at school. Children are sensitive and have a strong desire to be accepted by their peers, their teachers, and the class as a whole. When that acceptance is threatened, anxiety develops. If this happens again and again, the student tries to avoid the situation that caused the anxiety. In struggling to survive in the classroom, the child develops a phobia.

Children with math phobia usually seem to have little confidence in themselves. They feel they are not good in math; they refrain from asking questions (little realizing that more than half the class is puzzled over the same problem!); they are afraid to answer any question directed to them for fear of being labeled "dumb" or "stupid." Such fear or anxiety about math often begins during the pri-

many years and continues through life.

Perhaps it is not the fear of math per se, but rather apprehension about certain concepts that presents the difficulty. In talking with teachers and students and drawing from my own experience as a mathematics teacher, I have found that "word problems" top the list of anxiety-causing concepts for students. Even though it is not the only concept that causes math phobia, problem solving seems to be high on the list.

Problem Solving— A Top Priority in Math

The National Council of Teachers of Mathematics (NCTM) has published *An Agenda for Action: Recommendations for School Mathematics of the 1980s*. Their very first recommendation focuses on problem solving. Most math teachers view problem solving skills as vital to success in mathematics, and recognize that teaching them can in itself present a problem.

Just what is problem solving? What is involved in acquiring the skills that are needed for successful problem solving? In determining the answer to these questions, we first need to define the word *problem*. In the 1983 yearbook published by the NCTM, a mathematical problem is defined as a situation that involves a goal to be achieved, has obstacles to reaching that goal, and requires deliberation, since no known algorithm is available to solve it. Furthermore, problem solving is defined as a process, not a step-by-step procedure or an answer to be found.

What techniques should teachers use in dealing with children who have a fear of problem solving? In many cases, children have absolutely no desire even to try solving problems. However, the same is

true of some teachers! These teachers are afraid of math and carry that fear into their teaching. They feel threatened when asked to teach old math, new math, the metric system, or computer literacy and problem solving.

There is no best way to teach problem solving. Mathematics is problem solving, and hence instruction in this area should permeate all mathematics instruction. No single cut-and-dried procedure can be prescribed; however, in the paragraphs below, I will offer a few suggestions.

Prepare yourself to teach. Be enthusiastic about teaching and problem solving. Solve a variety of problems yourself so you will have the expertise to help students. What could be more exciting than to struggle with a problem and then suddenly hit upon the correct solution? A teacher who is filled with enthusiasm and confidence about mathematics and problem solving is ready to teach students how to solve problems.

Help your students to develop a positive attitude toward problem solving. Solve problems with them. Good teacher-student rapport is a great asset. It will help make students willing to take risks with unfamiliar tasks because they know their teacher is encouraging and supportive.

Studies indicate that students' anxiety about mathematics increases between the sixth and twelfth grade. Could this be because more difficult and abstract concepts are being introduced during this time? The teacher can help alleviate this anxiety by encouraging students to first solve simple one-step problems. After they have experienced success with easy tasks, the level of difficulty can be increased. Students should progress from one-step problems to multiple-step problems, from

problems that include only the necessary information to problems that give more information than is required. They can begin with problems involving only one operation and move to problems in which more than one operation is required to find the solution.

Groping Blindly for an Answer

Given a problem to solve, students will often just try to arrive at an answer—any answer. It is the teacher's responsibility to lead them, one step at a time, to use a planned approach and employ logical reasoning to analyze the problem *first* and then proceed to solving it, rather than taking a leap in the dark to arrive at an answer, whether reasonable or not. Since estimation plays an important role in problem solving, students should be taught this skill so they can determine whether their answer is reasonable.

In problem solving, arriving at the "correct answer" is not the most important step. More important is choosing the correct strategy for solving the problem. Even though there is only one correct answer, there will be more than a single correct strategy for solving a problem. When students are reassured of this fact, they will then be more willing to tackle new problems.

Whet Their Appetites

Children innately crave adventure; they always want to try something new. Don't curtail that desire by always assigning routine math activities. Research shows that children are very creative and good problem solvers when they start school. This makes one wonder what happens during the school years that causes such a traumatic change in some children. Could it be that one author was correct when he said, "My education was

only interrupted by my 13 years of school”?

Teachers need to develop and implement problem-solving activities in the classroom. Selection of materials is very important. Mathematics teachers should introduce an activity only after they have selected and modified the problems to meet the objectives they have set for themselves and their students.

Observation of problem-solving activities in British primary schools indicates that the teacher’s role could be better described as consultant, rather than just an authority figure. Children work with partners or in groups as both materials and children overflow into the hallways. The various scholastic disciplines collaborate in the planning and preparing of the math program. Children just starting school are placed with their older brothers and sisters, since this type of family grouping reduces the younger child’s anxiety.

Rosemary Schmalz, associate professor at the University of Scranton, Pennsylvania, taught junior high students during her sabbatical leave. She focused on problem solving. Students were given problems created from newspaper advertisements. There was much bustle and noise as students worked together, but it was welcome noise that stemmed from fruitful activity. When problem answers were specific, she made a display of the correct solutions so that students could verify their answers.

Using Problems From Daily Life

Schmalz’s experience illustrates the rule that problem solving should not be confined merely to story problems found in textbooks. Often these exercises are just computational problems using words. They do not really pose

problem-solving situations, nor do they help develop problem-solving skills.

Teachers can broaden students’ skills by making up their own problems based on situations one meets in daily life that require use of computational skills to solve. Such problems can require the use of manipulative materials, pictures, diagrams, charts, graphs, or other materials. If the assignments are meaningful, students won’t be so tempted to ask why they “have to do this stuff.”

I was shocked to discover that there were more word problems and multiple-step problems in the fifth- and sixth-grade textbooks in the 1930s than those printed in the 1970s. Listed below is a comparison of the data from those years as given by Matadial Mangru of the University of Iowa.

Verbal Arithmetic Problems	Mid 1930s	Early 1970s	Mid 1970s
5th grade	676	385	209
6th grade	658	392	269
Multiple Step Problems	Mid 1930s	Mid 1960s	Early 1970s
5th grade	231	63	57
6th grade	203	64	84

The startling decrease shown in the chart illustrates the need for teachers to create additional problems for students to solve.

Practice makes perfect! Although no one could possibly gain practice in all the different types of problems, the more problems students solve, the better problem solvers they will become. The time allotted for solving a problem has to be divided between analyzing the problem, arriving at a correct strategy, and then computing to get the solution. Since arriving at a correct strategy is vital in problem solving, the more types of problems one is able to analyze, the better problem solver he or she will become.

Calculators—Pro and Con

If time for computation can be reduced, more time can then be spent analyzing and finding a suitable strategy. For this reason, it is recommended that students be allowed to use calculators in problem solving.

Several studies have been conducted in the past decade analyzing the use of calculators in education. A review of these studies indicates that the findings have been rather contradictory. Significant difference was found in favor of calculator groups in only four out of 16 studies in which higher-level skills were measured. Wheatley found that sixth graders who used calculators in their instruction employed more problem-solving processes and made fewer errors than those who did not use calculators. Three

studies conducted by Szetela indicated that the use of calculators is a critical factor in solving story problems. However, he admits that the beneficial effects of calculators in story problem solving were limited to avoiding computational errors. Even so, calculators may be viewed as a useful tool in problem solving.

Using the Bulletin Board

Problem solving can be an exciting classroom activity. Set aside a bulletin board, changing the caption according to the season. For fall, have problems written on the leaves or hidden under them. The student gets to remove a leaf from

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Under the section, "Nature and Purposes of the Tests," the authors of the Iowa Tests of Basic Skills make this significant comment: "Tests are aids to better instruction. As with other such aids, the usefulness of tests will depend upon the extent to which the test results are interpreted with wisdom, ingenuity, and caution. Test results should be used to supplement, not to replace, teacher judgment."

A careful study of standardized tests and a knowledge of each individual child's strengths and weaknesses in math will enable the teacher to plan sequential instruction that best addresses the child's needs and prepares him or her to participate in today's increasingly technological society. □

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the board when he solves the problem. Divide the class into three or four teams. The team that removes the most leaves for the week or the

month is the winner. This helps avoid lag time with students who complete the assignment before the end of the math period.

When the season changes, replace the leaves with nuts and change the caption to "Crack the Nuts," and use more difficult problems. Snowflakes may be used with the title "Catch It If You Can," and blossoms for spring with the caption "Spring Into Math."

The teacher should assemble a collection of problems at different levels of difficulty. The section entitled "Challenge for Able Students" that appeared between 1981 and 1983 in *The Arithmetic Teacher* has excellent problems that may be used for this purpose. Students can be invited to contribute problems from their daily lives or their reading.

Life is full of problems. Everyone will surely encounter them in every part of his or her life. As teachers we must prepare our students for life—prepare them to meet problem situations and not

be overcome by them. If we have helped students not to be afraid to take risks, not to be fearful of unfamiliar tasks, not to be ashamed of failure but consider it a steppingstone to success, not to glory in success—realizing mightier tasks are ahead of them, then we will have done our part. If we have not yet totally reached our goal, we can be comforted by the knowledge that if we have done our part, the Lord will always make up for our deficiencies and fill in the gaps where we have failed. □

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Lively Math Teaching

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indicate when to change to one-on-one instruction (10 min.).

6. When it becomes apparent that most of the students understand how to proceed, devote the remaining time to the general practice session. During this time I devote myself entirely to individualized or small-group instruction. All grading and organizational work are put aside until later.

In conclusion, you must be prepared and inspired if you expect to be able to inspire others. If you, as a role model, transmit your internal excitement about your subject

