

# There's Hope for General Math

Teachers can make general mathematics classes more pleasant and productive by increasing the quality and quantity of communication, organizing student teams with shared responsibility for learning, and presenting review material and new content in more interesting, challenging ways.

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What's so bad about 9th grade general math? Just ask any general math teacher or student and be prepared to sit down and listen for awhile. You'll hear that general math is a tedious class to be endured, not enjoyed.

Frustrated teachers describe the typical general math student as academically unmotivated, not interested in mathematics, educationally behind, intellectually limited, and a potential behavior problem.

Students simply serve their time. Many fear or dislike math and expect to do a lot of boring routine problems before finally waving good-bye to math classes forever. Most never want to see another math class as long as they live.

Sounds dismal, but it's not hopeless. Teachers can make general math more pleasant and productive. Researchers at the Institute for Research on Teaching<sup>1</sup> at Michigan State University, in collaboration with math teachers, have been studying general math and algebra classes for several years. They have described the difficulties general math teachers face and identified instructional areas in which improvements are possible.

In suggesting improvements, the researchers do not mean to imply that math teachers are not teaching well. Most teachers are doing what they feel is necessary to cope with a difficult situation. But when given sound suggestions based on valid research, teachers can go beyond coping with the situation and begin to improve it.



Dorothy Pravat

## Strategies to Improve Teaching and Learning

Researchers at the Institute have come up with three strategies for improving teaching and learning in general math classes.

1. *Increase the quality and quantity of communication about mathematics.* Both teachers and students should talk more math. The research staff found that teachers typically spend 10 minutes or less presenting and developing math concepts and skills in general math class, compared with 25–35 minutes in algebra classes.

Admittedly, spending more time on presentation, discussion, and development may conflict with a teacher's ideas about how to best run the class. One teacher working with the researchers said her strategy was to "keep them quiet and give them lots of problems." She thought that was how her students would learn best. But when she engaged the whole class in dialogue about math, asking students

to explain their thinking and reasoning as they solved problems, she found her students learned more.

I think the questioning of students' responses in large-group situations probably is one of the bigger changes that has been helpful to me; I can use students' feedback in a large-group situation to teach the whole group.

The researchers also noted that general math teachers tend to abandon the precise mathematical terminology they use in their algebra classes. For example, teachers typically read 368.2 as "three six eight point two" to their general math students instead of the more mathematically precise "three hundred sixty-eight and two tenths." More precise communication about math helps reinforce mathematical concepts.

Communication goes two ways in classrooms, and students should be given opportunities to explain their reasoning for solving problems. One teacher said, "I was surprised at how much they had to say about math."

Communication in general math classes should focus on conceptual understanding. The researchers suggest that teachers present a concept in a concrete, pictorial, symbolic format before teaching the computational algorithms. One teacher found this frustrating at first but rewarding in the long run. When she initially asked students questions about their conceptual understanding of fractions and then listened intently to their answers, she became discouraged by how little they knew, and had to teach at a much slower pace than she would have

liked. When the unit ended, however, several of her students admitted that this was the first time they really understood fractions. When the class moved on to percents, these students found their new understanding of fractions made learning percents easy.

2. *Use the social organization of the classroom to facilitate instruction.* There's a wide mix of personalities in a typical general math class—usually more loners and more life-of-the-party types than in algebra classes. Getting them to work together can be quite a challenge. The idea is to convince them that they're capable of helping one another learn math.

The researchers suggest that teachers try cooperative learning strategies (Artzt, 1979; Johnson, Johnson, Holubec, Roy, 1984; Slavin, 1978). One such strategy involves organizing students into teams of four to six in which they share responsibility for each other's learning. The most successful team is given some award or recognition, and points are given for improvement as well as achievement, so that all students have a chance to contribute to their team's score.

One teacher was convinced that some students would refuse to work that way. "It was hard for me to let go of my control over the class," she said. After trying it, however, she was convinced it could work. She described a review day on which she had her

students do worksheets in their groups:

They were drilling each other, and they were working. I mean, I went around the room, and they almost said, "Leave me alone. We're gonna get him to learn this. . . ." It was so much fun. I loved it. . . . And I had one kid call a kid up at home asking if he had his ditto done.

The groups had competed for the honor of leaving the room without having to put up chairs, and the teacher was amazed at their zeal.

She now believes that the most significant benefit of group work is the increased amount of communication about mathematics, which she says helps students develop their math language and loosens them up for more class participation.

3. *Teach new topics or modify existing ones and assign interesting and challenging problems.* "We did that last year. Why do we have to do it again?" So goes the all-too-familiar lament of general math students whether they understand the material in question or not. Presenting new content and teaching old content in a different and challenging way can help make general math more interesting.

For example, two teachers tried using fraction kits with their regular unit on fractions. They asked their students to cut out circles from different colors of construction paper, then cut one circle into halves, one into thirds, one

into fourths, and others into fifths, sixths, eighths, ninths, tenths, and twelfths.

Said one teacher at the beginning of the unit,

I don't think they realize at this point that three thirds make a whole without doing the manipulatives. This amazes me, and it makes a very convincing case for the manipulatives.

The students used their fraction kits throughout the unit to concretely reinforce the concepts they were learning.

New units the teachers taught with some success were probability, statistics, problem solving, graphing, and estimation. Said one teacher, "The probability unit was worthwhile as a method of getting at computational skills." The students found the new units interesting, a real reprieve from the "same old stuff." Their self-confidence went up because they had been able to learn some new and challenging material. And, with the benefit of greater student interest, the teachers were able to reinforce the basics they felt were so important. □

The Institute for Research on Teaching has prepared an annotated reading list for anyone who wants to learn more about improving general math instruction. For a copy of that list, write to "General Math Reading List," c/o Anne Madsen-Nason, 252 Erickson Hall, Michigan State University, East Lansing, MI 48824-1034. To find out more about the information presented in this article, contact Perry Lanier, Institute for Research on Teaching, College of Education, Michigan State University, East Lansing, MI 48824.

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