

ClassroomLeadership

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Improving Achievement in Math and Science

Using Math to Teach Thinking

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"I don't know what to do."

Are some of your students quick to decide that they don't understand something—sometimes even before attempting to solve a problem? And are you sometimes too quick to supply a formula that students can apply and memorize? Here's the hitch: when we simply give students the steps to follow, they may be able to find the correct answer more quickly, but they may not be able to explain *why* applying a particular formula resulted in the right answer.

A better approach, I've discovered, is to hit the ball back into the students' court: *"Well, what do you think you should do?"*

We need to help students to become thinkers. How? By asking them to attempt problems, examine answers, share strategies, and then reexamine their processes and solutions.

Asking Questions

Helping students become reflective problem solvers begins with asking questions: What's the purpose? How did you solve that? Is there a more efficient way? Although the teacher usually begins the practice, students soon start asking themselves these questions on a regular basis.

We then need to use real-life problems that children can relate to. We want students to see how daily life can be part of the great math experience. For example, I may write on the board: Bottled drinks can be purchased, 4 for \$5.00. How much is each drink? Students copy the problem and work through it in their own ways. When they're ready, I visit with each student and ask him to tell me what he did. As the students share, they reflect. Some will ask for reassurance, some will change their minds. I simply listen and respond with questions to promote more thinking. When students are successful, I encourage them to look for ways to solve the problem more efficiently.

I also ask students to share their problem-solving processes with their peers. How can we be better thinkers if we aren't exposed to new ways of thinking? Volunteers approach the board and show us their strategies. As a group, we decide if the methods make sense. I always ask for someone to solve the problem a different way, hoping that it will prompt children to compare and contrast: "Oh yeah, that seems easy!" or "I like my way better." My goal is to



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enable students to use the strategy that best makes sense to them.

Talking About Numbers

At least three times a week, for about 10 minutes each time, my students and I engage in "Number Talk." Here's how it works:

First, I display a problem such as $23 + 19 = ?$ on an overhead or write it on the board.

Students mentally solve the equation and put their thumbs underneath their chins when they have the answer (this lets me know when they are ready without interrupting other students).

Next, I make a list of students' answers and ask them to decide: Which answers are possible? Impossible? Students immediately begin to reflect, and some may want to change their answer or take it off the list.

Then, children show and describe how they arrived at their answers. This sharing time is so powerful because it allows students to see that, while we are all working on the same problem, there are many different paths of thinking. Our purpose is to identify patterns and efficient ways to solve problems. In fact, to promote different thinking even further, I often require students to work the same problem two different ways.

Moving Beyond Formulas

I do think that it's my responsibility to introduce to and explore with my students math concepts such as friendly numbers, doubles, negative numbers, patterns, and charts. Students will use these concepts as tools in solving problems. My key responsibility, however, is to help students activate their higher-order thinking and reasoning skills. In doing so, they will be equipped to grapple with the much more challenging problems they'll have later in life.

I must give my students opportunities to make decisions. Will they make poor choices? Of course. Everyone does. But, they will also be prepared to evaluate their own thinking to determine if a better solution is possible. Children with this capacity will be the competent and competitive leaders of tomorrow.

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