President's Message

Do the Math in Your Head!

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What does it mean to know mathematics? This is a complex question, but there is strong agreement that facility with numbers and skill in problem solving play important roles. *Principles and Standards for School Mathematics* calls for students to be proficient with tools that include pencil and paper and technology, as well as mental techniques. I would like to make a case for raising the importance of *mental math* as a major component in students' tool kits of mathematical knowledge. Mental math is often associated with the ability to do computations quickly, but in its broadest sense, mental math also involves conceptual understanding and problem solving.

Mental Math Concepts

Understanding what numbers mean and what operations mean is the foundation for learning increasingly complex mathematics. Younger students should be able to recognize the number of objects represented in familiar patterns such as the five dots on the side of a die or eight objects arranged in two rows of four. For two- or even three-digit numbers, they might associate a numeral with a base-ten model that shows ones, tens, and hundreds. Students need mental pictures of a range of numbers like 10, 88, or 125. Carrying such mental pictures of the size and value of numbers prepares students for learning addition and multiplication facts and for solving simple problems involving computation. As students develop the mental ability to see numbers as being made up of other numbers (for example, seeing 125 as 100 + 20 + 5), their understanding of the number system expands.

Mental Computation

Ideally, students should have ready mental recall of their single-digit addition and multiplication facts. Ready knowledge of such facts for solving problems is an important component of mathematical knowledge. Beyond facts, I also believe that students should know how to multiply numbers mentally by 10, 100, or 1,000. Additionally, students should be able to come up with combinations that add up to 10 or 100. Students should know the pairs of whole numbers that add up to 10, realizing that, for instance, both 6 + 4 and 4 + 6 represent the same thing. When presented with a number like 37, students should be able to think of 63 as its "hundred partner." There are many other quick tips and mental shortcuts that can help students perform calculations mentally or that can aid them as they perform paper-and-pencil calculations.

Mental Problem Solving

Problem solving continues to be a high priority in school mathematics. Some argue that it is the most important mathematical goal for our students. Mental math provides both tools for solving problems and filters for evaluating answers. When a student has strong mental math skills, he or she can quickly test different approaches to a problem and determine whether the resulting path will lead toward a viable solution. Estimation skills require both a sense of number and facility with mental computation and can provide a ballpark answer to a problem before the student attempts to solve it. They also offer a comparison point by which to judge whether a result is reasonable for the given situation. Estimation is an important skill for inclusion in students' tool kits, whether they perform calculations with a pencil and paper or on a calculator.

Investing in Mental Math

Mental math proficiency represents one important dimension of mathematical knowledge. Not all individuals will develop rapid mental number skills to the same degree. Some will find their strength in mathematics through other avenues, such as visual or graphic representations or creativity in solving problems. But mental math has a clear place in school mathematics. It is an area where many parents and families feel comfortable offering support and assistance to their children.

Mental math need not depend on rote memorization. In fact, the development of mental models for numbers and operations is greatly facilitated by students engaging in purposeful experiences with concrete objects and number patterns. Teachers play a vital role in making sure that these experiences are connected in meaningful ways to the mathematics we ask students to learn.

In my observation, mental math does not receive the attention it deserves. Perhaps this is because the development of mental techniques is not always explicitly stated as an objective or state-level standard. Whatever the reason, the time has come to invest in helping students build the mental math skills in their tool kits as part of their comprehensive mathematical understanding. The payoff for this investment can be tremendous both in improving students' mathematical abilities and in giving a visible sign that we are committed to preparing students with the kind of mathematical proficiency that the public can readily appreciate.

What are some of the most important mental math skills, tips, or shortcuts that students should know? What are some ways to help students develop their mental math facility? Join me for a chat about these questions and related issues on December 13 at 4:00 p.m. EST. Ω

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