How Students Learn: Mathematics in the Classroom

Research Roundup » Volume 24, Number 4, Summer 2008


This teacher-oriented, research-based resource was developed by members of the National Research Council’s Committee on How People Learn and builds on learning principles discussed by the committee in a previous publication, How People Learn. Chapter authors Fuson, Kalchman, and Bransford begin the volume by providing a brief overview of these principles and relating them to mathematics instruction.

**Teachers must engage students’ preconceptions.** This principle “emphasizes both the need to build on existing knowledge and the need to engage students’ preconceptions—particularly when they interfere with learning.” The authors describe three strategies that support these goals:

- Allowing multiple strategies, perhaps by helping students explore and discuss their own methods to “see what is easy and difficult about each of them.” By providing an instructional environment in which there is not always a single correct approach, students will learn to focus on the process of problem-solving, not simply on whether the answer is right or wrong.
- Encouraging math talk “to make students’ thinking visible.” This approach provides the teacher with better information to use when diagnosing student difficulties, and it makes more than one “teacher” available to help students make connections.
- Designing “bridging instructional activities” that “preemptively” address areas of misconceptions students often have. For example, abstract concepts such as multidigit numbers should be first represented by concrete objects (e.g., the number 24 represented by two piles of 10 objects, plus a pile of four objects).

**Understanding requires factual knowledge and conceptual frameworks.** Instruction that supports this principle would include opportunities for students to build procedural fluency—for example, accurately doing double-digit multiplication—while developing an understanding of the core concepts. Such an approach provides students with the connections they need to move on to more difficult concepts and to use the procedures in new contexts.

**A metacognitive approach enables student self-monitoring.** The authors describe an “emphasis on debugging” as an approach that supports student development of metacognitive skills. This involves shifting from a focus on answers as right or wrong to a more detailed focus on “debugging” a wrong answer—that is, finding the error, understanding why it is an error, and correcting it.

In another chapter, “Fostering the Development of Whole-Number Sense,” Sharon Griffin takes an interesting and helpful approach to the teaching of math in the early grades by stressing the need to build on children’s developmental levels. She describes typical mathematical understandings of children at ages 4-8.

*How Students Learn: Mathematics in the Classroom* provides an excellent connection of theories about learning and child development to mathematics instruction. While it is not simply a list of teaching tips, it does provide examples that make it a solid resource for teacher groups in discussions about improving math instruction.