

MATH EDUCATION

Academy Report Aims To Quiet Debate

It's often said that those who walk down the middle of the road risk getting hit from both sides. But a new report* from the National Academy of Sciences on how children learn math flaunts its centrist tendencies in calling for improving how the subject is taught in U.S. elementary and middle schools. Its message is deliberately crafted to quiet the raucous "math wars" by summarizing what researchers have learned about student and teacher competencies and suggesting how to assess their progress. Initial reaction suggests that it may succeed.

"We want to move past the debate over skills versus understanding. It's not one or the other," says panel chair Jeremy Kilpatrick, a professor of mathematics education at the University of Georgia, Athens. "The point is that both are needed, and more, to learn and understand mathematics." Most professional societies fall into the "understanding" camp, exemplified by the most recent standards issued by the National Council of Teachers of Mathematics (NCTM), which stress hands-on learning and the importance of concepts along with mastery of procedures. The California-based grassroots lobbying group, Mathematically Correct, has led the charge for "skills-based" instruction, which puts greater emphasis on getting the right answers, through practice and memorization, than on broader conceptual exercises.

A desire to improve math instruction is a driving force behind broad education reform plans put forward last week by both President George Bush and congressional Democrats. Although the academy report doesn't address either plan directly, it offers a new definition of mathematical proficiency that, if adopted widely, could influence state and federal efforts. The definition bridges the two camps by including both conceptual understanding and procedural fluency. It also emphasizes the importance of solving problems, thinking logically, and seeing math as useful and worthwhile. The report recommends using those same categories to assess teacher performance and urges public officials to spend

much more on teacher preparation and professional development.

"I think they did a solid job," says Janice Earle of the National Science Foundation, which along with the U.S. Department of Education funded the \$1.58 million study. "In particular, I think that their notion of mathematical proficiency is richer than past definitions. Beyond that, I think they accomplished the goal of bringing together a credible group of people to look at the data and say, 'This is what makes sense.'"

The report, which took 2 years to complete and is 9 months overdue, is the product of a 16-member panel of mathematicians, math educators, cognitive scientists, and practitioners carefully chosen to be broadly representative of their fields. The topic was so sensitive politically that academy officials bypassed a standing body, the Mathematics Science Education Board—which is looked on with suspicion by the skills-based learning camp—and created an ad hoc Mathematics Learning Study Committee to take on the task. Then, to avoid any taint of bias, they formed another temporary body to oversee the selection of panelists and reviewers.

Mathematician and panelist Hung Hsi Wu of the University of California, Berkeley, can testify to the apparent success of that balancing act. Wu has been heavily in-

ernment spend more money on long-term professional development and get serious about improving math instruction."

Mathematically Correct co-founder Paul Clopton, a statistician with the Department of Veterans Affairs hospital in San Diego, says he has "mixed feelings" about the report, worrying that some of its language echoes the original 1989 NCTM standards. But he couldn't agree more with its focus on teacher preparation. "That's the part I like best. But it's the hardest thing to do, and the thing that will take the longest to accomplish."

The academy plans to discuss the report at a public symposium. It also hopes to issue condensed versions of the 440-page report for targeted audiences including educators, policy-makers, and parents.

—JEFFREY MERVIS

REPRODUCTIVE BIOLOGY

Cloning: Could Humans Be Next?

The largely theoretical debate over human reproductive cloning became more concrete last week. Reproductive physiologist Panos Zavos of the University of Kentucky, Lexington, and Italian fertility doctor Severino Antinori told a meeting of fertility experts on 26 January that they, with several unnamed collaborators, would attempt to produce a baby through cloning within the next 2 years. The project would take place in a Mediterranean country, they said.

Although such an effort faces significant hurdles—and high risks—the claim can't be dismissed quite as easily as those of other groups that have declared their intentions to attempt human cloning. Last week's announcement is the first in which the would-be cloners have experience in assisted reproduction techniques. Zavos is co-founder of a fertility clinic in Kentucky and conducts research in male infertility. Antinori is known for his controversial efforts to help postmenopausal women become pregnant—one of his patients gave birth at age 62. Zavos said the team will only help patients who can reproduce no other way, such as a woman whose ovaries had been removed. As for fertile couples who want to clone a deceased child, "I doubt very much that they would qualify under our guidelines," Zavos told *Science*.

Experts in animal cloning say there is no inherent reason why nuclear transfer technology would not work in humans, with enough funding and know-how. "I'm sure it's doable," says Michael Bishop of Infigen, a biotechnology company in DeForest, Wisconsin, that has cloned more than 100 cattle and dozens of pigs. But would it be safe? In animal cloning to date, says Bishop, surrogate mothers do not suffer greater complica-

Estimate the answer to adding $12/13$ and $7/8$. You will not have time to solve the problem with pencil and paper.

Answer: A) 1
B) 2
C) 19
D) 21

Fractured thinking. Only 24% of eighth graders, and 37% of high school seniors, chose the correct answer, B. A majority of 13-year-olds answered C or D, presumably after adding either the numerators or the denominators. "It shows the lack of even a basic understanding of what fractions are," notes academy panel member Thomas Carpenter, a math and science education researcher at the University of Wisconsin, Madison. "What we're saying is that without conceptual understanding, the skills will eventually be forgotten, and you'll make bizarre mistakes like this."

involved in California's fractious efforts to revamp its math curricula, and his writing is widely cited by Mathematically Correct. Yet he has long insisted that the dichotomy between skills and understanding is "bogus," and he praises the new report for making that point clear. "I think that thoughtful people on both sides are moving toward a middle ground, and this report can help that process along," says Wu. "In my mind, the most important recommendation is that the gov-

* "Adding It Up: Helping Children Learn Mathematics," National Research Council, 2001 (www.nationalacademies.org).