

## EDUCATION WEEK

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### Panel Calls for Systematic, Basic Approach to Math

**Federal advisory group's proposals may reignite debate on 'broken' content and instruction**

By [Sean Cavanagh](#)

The influence of a federal report calling for a more orderly approach to teaching mathematics in the early grades will hinge largely on whether its message is accepted by the nation's diverse and often fiercely divided math community, members of the panel that crafted it acknowledge.

Released this week, [the report of the National Mathematics Advisory Panel](#)

recommends that schools present elementary and middle school math in a better-defined manner, in contrast to the jumble of strategies now used in states and school districts.

"The delivery system in mathematics education—the system that translates mathematical knowledge into value and ability for the next generation—is broken and must be fixed," it says. "This is not a conclusion about any single element of the system. It is about how the many parts do not now work together to achieve a result worthy of this country's values and ambitions."

Initial reaction to the report, "Foundations for Success," was mixed.

Andy Isaacs, the director of the most recent edition of Everyday Mathematics, one of the nation's most widely used elementary school textbook series, said there was a "tremendous amount" of the report that made sense to him.

But Mr. Isaacs also said he was worried that the document's call for a strong refocusing on arithmetic and math procedures would discourage the use of other effective classroom methods.

"You could read it as really wanting to narrow the school curriculum down to core arithmetic," said Mr. Isaacs, who is based at the University of Chicago. "In education, we're always overcorrecting—going from one extreme to another."

**'First Things First'**

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Nearly two years in the making, the report went through 90 drafts, with its members wrestling over major recommendations and individual words and phrases. It was approved unanimously at the panel's final meeting, held March 13 at Longfellow Middle School here in a suburb of the nation's capital.

The 90-page document calls for the math curriculum to be streamlined in pre-K-8, a strategy it calls putting "first things first." Students need to be grounded in both the effortless, automatic recall of simple procedures and in the acquisition of broader problem-solving skills. Too often, those skills are wrongly presented as incompatible, the report says.

At various points, the authors also allude to the enduring philosophical battles over how to teach the subject—commonly referred to as "the math wars." Those disputes tend to pit those who argue that students should be grounded more firmly in simple math procedures against others who advocate a more conceptual approach to teaching and learning.

The arguments, the panelists believe, miss the point.

"Debates regarding the relative importance of these aspects of mathematical knowledge are misguided," the report says. "These capabilities are mutually supportive, each facilitating the learning of the other."

But the authors also identify a clear path to prepare students for introductory algebra and advanced math—the central charge given to the panel. Students should become proficient with whole numbers, fractions, and aspects of geometry and measurement in order to steel themselves for algebra, typically taught in the 8th or 9th grade, the report says. State tests, teacher education programs, and textbooks should be tailored to promote those skills; so should the National Assessment of Educational Progress, known as "the nation's report card," it says.

### **Identifying Skills**

At their final meeting, a number of panelists urged math teachers and academic scholars, as well as influential professional associations, to help them promote the report's findings—even if some recommendations disappoint them.

Organizations such as the 100,000-member National Council of Teachers of Mathematics—whose president, Francis M. "Skip Fennell, served on the panel—will play a strong role in determining whether its ideas are translated for K-12 teachers, panel Chairman Larry R. Faulkner said after the meeting.

"Responsibility for education in this country is so decentralized," said Mr. Faulkner, a former president of the University of Texas at Austin. Math organizations and associations are often "the best way to connect" to teachers and policymakers, he said.

President Bush signed an executive order creating the panel in April 2006. The group, which has 19 voting and five nonvoting members, was charged with identifying the math skills students need to ready themselves for introductory algebra and higher-level math, based on the "best available scientific evidence." Educators generally regard algebra as a crucial first

step in preparing students for advanced math.

The panel's report repeatedly calls for students to be able to recall math procedures, such as basic addition, subtraction, multiplication, and division, quickly and effortlessly. It also says that students' difficulty with fractions is "pervasive" and a "major obstacle" to learning algebra.

### Emphasis Debated

Being able to recall basic number facts automatically reduces the strain on students when they encounter more-demanding tasks in algebra, said panelist Vern Williams, who teaches that subject at Longfellow Middle School.

"If your mental energy is consumed figuring out what six times nine is, when that should have been covered three or four years ago, how are you going to conceptualize about math?" Mr. Williams said after the meeting.

But Steven Rasmussen, the publisher of Key Curriculum Press, a producer of math textbooks and software based in Emeryville, Calif., said the report's heavy emphasis on basic arithmetic and fractions—which he regards as important—left out other topics that help prepare students for high school math.

Exposure to basic elements of data analysis, statistics, and applied math, engage students and allow them to relate math to workforce skills, he said.

"This report is biased in favor of teaching arithmetic and not [modern] mathematics," Mr. Rasmussen said, "and it's biased in favor of procedures and not applied skill."

In seeking to base its recommendations on the kind of evidence specified by the White House order, the panel ranked studies of math programs and strategies in categories ranging from "strong evidence" to "inconsistent" to "weak," depending on the methodology the studies used.

Mr. Rasmussen and Jere Confrey, a professor of math education at North Carolina State University in Raleigh, said the panel's criteria

### Core Recommendations

#### The Definition of Algebra

"The panel developed a clear concept of school algebra" courses, which the report says should include coverage of: symbols and expressions; linear equations; quadratic equations, functions, algebra of polynomials; and combinatorics and finite probability. These should be the focus of state curriculum frameworks, algebra courses, textbooks, and end-of-course exams.

#### Struggles with Fractions

"A major goal for K-8 mathematics education should be proficiency with fractions (including decimals, percents, and negative fractions), for such proficiency is foundational for algebra and, at the present time, seems to be severely underdeveloped."

#### Math Wars

"To prepare students for algebra, the curriculum must simultaneously develop conceptual understanding, computational fluency, and problem-solving skills. Debates regarding the relative importance of these aspects of mathematical knowledge are misguided. These capabilities are mutually supportive, each facilitating the learning of the others."

#### Helping Disadvantaged Students

"Children's goals and beliefs about learning are related to their mathematics performance. Experimental studies have demonstrated that changing children's beliefs from a focus on ability to a focus on effort

were too restrictive, however.

Case studies and other research that do not meet the “scientific evidence” standards used by the panel could provide valuable information on the true impact of math programs and interventions in the classroom, Ms. Confrey argued. The panel gives “short shrift to the need for multiple methods of research,” she wrote.

But panel members also discovered that some areas related to math education, such as cognitive studies of how children learn, have produced much more high-quality research than others, such as how to prepare math educators and give them ongoing professional development, said Mr. Faulkner, the chairman.

“We’re going to have to learn more about what makes a good teacher and how to instill” those abilities, said Mr. Faulkner. “Very little is known about these things,” he added, “surprisingly little, given [their] importance.”

Bush administration officials have compared the math advisory group to the National Reading Panel, which in 2000 produced a report that influenced instruction in that subject. The reading panel, originally authorized by Congress in 1997, during the Clinton administration, recommended that explicit phonics and the direct teaching of other basic skills be a core part of elementary reading instruction. Phonics connects sounds to the letters of the alphabet.

Some researchers and educators complained that the reading panel focused on a small body of research and a narrow range of topics for its report. Consequently, they say, policies and commercial products have underemphasized several components they view as important for students’ reading achievement, such as writing instruction and background knowledge.

The reading panel’s recommendations shaped the grant requirements under the \$1 billion-a-year Reading First program. Congress recently slashed the program’s budget to \$393 million for fiscal 2008, amid complaints about favoritism and conflicts of interest in its

increases their engagement in mathematics learning, which in turn improves mathematics outcomes. [Research shows] that the engagement and sense of efficacy of African-American and Hispanic students in mathematical learning contexts tend to be lower than that of white and Asian students, but also that it can be significantly increased.

#### **Teacher- vs. Student-Centered Instruction**

“All-encompassing recommendations that instruction should be entirely ‘child-centered’ or ‘teacher-directed’ are not supported by research...High-quality research does not support the exclusive use of either approach.”

#### **‘Explicit’ Instruction**

“Explicit instruction with students who have mathematical difficulties has shown consistently positive effects on performance with word problems and computation.” The panel defines that term to mean “that teachers provide clear models for solving a problem type using an array of examples, students receive extensive practice in use of newly learned strategies and skills, students are provided with opportunities to think aloud [talking through decisions they make and steps they take], and students are provided with extensive feedback.”

#### **What Research Says (or Does Not Say)**

“As in all fields of education, the large quantity of studies ... on important topics in mathematics education is reduced appreciably once contemporary criteria for rigor and generalizability are applied.” Government agencies should increase their support for research on math education, the report states, and emphasize “stringent methodological criteria,” such as randomized controlled designs and methodologically rigorous quasi-experimental studies.

Source: National Mathematics Advisory Panel

implementation.

### **NCTM Reaction**

The impact of the math panel's report is unclear at this point. No single federal program in math compares to Reading First in influence or level of funding. A federal report released last year identified 105 separate programs, which spend a total of \$3 billion on education in the so-called STEM subjects—science, technology, engineering, and math—across several agencies, about \$570 million at the K-12 level.

U.S. Secretary of Education Margaret Spellings told reporters after the meeting that she would ask other agencies to consider using the panel's recommendations to shape grant awards and other policies. While Mr. Bush, who commissioned the report, will leave office in less than a year, the report will shape education policy long after that, she predicted.

"This really transcends politics or administrations," Ms. Spellings said.

The math panel included a number of cognitive psychologists, researchers, and college faculty members who have studied math issues. Mr. Fennell, the NCTM president and panel member, said he hoped the document would encourage a nationwide push for "greater coherence" in math instruction.

The math teachers' council, based in Reston, Va., has angered some parents and mathematicians who believe it has pushed a style of math focused too much on conceptual learning and not enough on automatic recall of number facts. But the organization also won praise from its critics more recently, with its publication in 2006 of "**Curriculum Focal Points**," a document aimed at streamlining the list of key math topics in prekindergarten through 8th grade, which NCTM has been promoting nationwide.

James M. Rubillo, the NCTM's executive director, who attended the national math panel's final meeting, said early drafts of the report had drawn mixed reactions from his organization's members. He said he was pleased with the report's use of "Focal Points" as a reference guide for how math should be taught at early grades.

The report brings "unprecedented focus" to math instruction, the NCTM said in a statement, and "addresses many of the actions needed" to improve math education.

But Mr. Rubillo said the report's language about calculators was not firmly grounded in research. The report, citing a limited number of studies, found that those devices have "limited or no impact" on certain math skills. The NCTM has been generally supportive of calculators' role in the classroom.

While many panel recommendations "are supported by high-quality research, others extend beyond the report's reach," the NCTM said in a statement. Many of the issues raised in the report, it said, still "require extensive and ongoing research in order to identify approaches that can be broadly applied."