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# Report Urges Changes in Teaching Math

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American students' math achievement is "at a mediocre level" compared with that of their peers worldwide, according to a new report by a federal panel, which recommended that schools focus on key skills that prepare students to learn algebra.

"The sharp falloff in mathematics achievement in the U.S. begins as students reach late middle school, where, for more and more students, algebra course work begins," said the report of the National Mathematics Advisory Panel, appointed two years ago by President Bush. "Students who complete Algebra II are more than twice as likely to graduate from college compared to students with less mathematical preparation."

The report, adopted unanimously by the panel on Thursday and presented to Education Secretary [Margaret Spellings](#), said that prekindergarten-to-eighth-grade math curriculums should be streamlined and put focused attention on skills like the handling of whole numbers and fractions and certain aspects of geometry and measurement.

It offers specific goals for students in different grades. For example, it said that by the end of the third grade, students should be proficient in adding and subtracting whole numbers. Two years later, they should be proficient in multiplying and dividing them. By the end of the sixth grade, the report said, students should have mastered the multiplication and division of fractions and decimals.

The report tries to put to rest the long, heated debate over math teaching methods. Parents and teachers have fought passionately in school districts around the country over the relative merits of traditional, or teacher-directed, instruction, in which students are told how to do problems and then drilled on them, versus reform or child-centered instruction, emphasizing student exploration and conceptual understanding. It said both methods had a role.

"There is no basis in research for favoring teacher-based or student-centered instruction," Dr. Larry R. Faulkner, the chairman of the panel, said at a briefing on Wednesday. "People may retain their strongly held philosophical inclinations, but the research does not show that either is better than the other."

The report found that "to prepare students for algebra, the curriculum must simultaneously develop conceptual understanding, computational fluency and problem-solving skills." Further, it said: "Debates regarding the relative importance of these aspects of mathematical knowledge are misguided. These capabilities are mutually supportive."

The president convened the panel to advise on how to improve math education. Its members include math and psychology professors from leading universities, a middle-school math teacher and the president of the National Council of Teachers of Mathematics.

Closely tracking an influential 2006 report by the National Council of Teachers of Mathematics, the panel recommended that math curriculum should include fewer topics, spending enough time to make sure each is learned in enough depth that it need not be revisited in later grades. That is the approach used in most top-performing nations, and since the 2006 report, many states have been revising their standards to cover fewer topics in greater depth.

The report calls for more research on successful math teaching, and recommends that the secretary of education convene an annual forum of leaders of the national associations concerned with math to develop an agenda for improving math instruction.

Ms. Spellings said Thursday that she would convene such a meeting. She emphasized the importance of math education for all children and said the report underlined the need for parents to teach even young children about numbers and measurements.

Ms. Spellings said she hoped the report would help persuade Congress to approve the president's fiscal 2009 budget request for almost \$100 million for Math Now, an instructional program proposed last year and not financed.

The report cited a number of troubling international comparisons, including a 2007 assessment finding that 15-year-olds in the United States ranked 25th among their peers in 30 developed nations in math literacy and problem solving.

Fractions are especially troublesome for Americans, the report found. It pointed to the [National Assessment of Educational Progress](#), standardized exams known as the nation's report card, which found that almost half the eighth graders tested could not solve a word problem that required dividing fractions. Panel members said the failure to master fractions was for American students the greatest obstacle to learning algebra. Just as "plastics" was the catchword in the 1967 movie "The Graduate," the catchword for math teachers today should be "fractions," said Francis Fennell, president of the National Council of Teachers of Mathematics.

After hearing testimony and comments from hundreds of organizations and individuals, and sifting through a broad array of 16,000 research publications, the panelists shaped their report around recent research on how children learn.

For example, the report found it is important for students to master their basic math facts well enough that their recall becomes automatic, stored in their long-term memory, leaving room in their working memory to take in new math processes.

"For all content areas, practice allows students to achieve automaticity of basic skills — the fast, accurate and effortless processing of content information — which frees up working memory for more complex aspects of problem solving," the report said.

Dr. Faulkner, a former president of the University of Texas at Austin, said the panel "buys the notion from cognitive science that kids have to know the facts."

The report also cited findings that students who depended on their native intelligence learned less than those who believed that success depended on how hard they worked.

Dr. Faulkner said the current "talent-driven approach to math, that either you can do it or you can't, like playing the violin," needed to be changed.