



SAMPLE MATERIAL

## National Mathematics Advisory Panel: Core Principles of Instruction

National Mathematics Advisory Panel, U.S. Department of Education

**Topic:** Response to Intervention in Elementary-Middle Math

**Practice:** Foundations of Arithmetic

The National Mathematics Advisory Panel conducted a rigorous, systematic review of the best available scientific evidence for teaching and learning math and provided concrete recommendations to improve math education, with a specific focus on preparation for learning algebra. The Panel's final report<sup>1</sup> contains 45 findings and recommendations on topics including instructional practices, materials, professional development, and assessments. This two-page fact sheet summarizes the panel's findings on the core principles for math instruction.

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<sup>1</sup> Learn more about the Panel's findings and to download the full report, *Foundations for success: The final report of the National Mathematics Advisory Panel* at: <http://www2.ed.gov/MathPanel>.

## National Math Panel

March 2008

To compete in the 21st century global economy, knowledge of and proficiency in mathematics is critical. Today's high school graduates need to have solid mathematics skills—whether they are headed for college or the workforce. To help ensure our nation's future competitiveness and economic viability, President George W. Bush created the National Mathematics Advisory Panel (National Math Panel) in April 2006.

The panel was charged with providing recommendations to the President and U.S. Secretary of Education Margaret Spellings on the best use of scientifically based research to advance the teaching and learning of mathematics. Expert panelists, including a number of leading mathematicians, cognitive psychologists, and educators, reviewed numerous research studies before preparing a final report containing guidance on how to improve mathematics achievement for all students in the United States.

The National Math Panel's final report, issued on March 13, 2008, contains 45 findings and recommendations on numerous topics including instructional practices, materials, professional development, and assessments. Highlights from the report are briefly summarized below. Please visit [www.ed.gov/MathPanel](http://www.ed.gov/MathPanel) for the executive summary and full report.

### Core Principles of Math Instruction

- The areas to be studied in mathematics from pre-kindergarten through eighth grade should be streamlined and a well-defined set of the most important topics should be emphasized in the early grades. Any approach that revisits topics year after year without bringing them to closure should be avoided.
- Proficiency with whole numbers, fractions, and certain aspects of geometry and measurement are the foundations for algebra. Of these, knowledge of fractions is the most important foundational skill not developed among American students.
- Conceptual understanding, computational and procedural fluency, and problem solving skills are equally important and mutually reinforce each other. Debates regarding the relative importance of each of these components of mathematics are misguided.
- Students should develop immediate recall of arithmetic facts to free the “working memory” for solving more complex problems.
- The benchmarks set forth by the Panel should help to guide classroom curricula, mathematics instruction, textbook development, and state assessments.
- More students should be prepared for and offered an authentic algebra course at Grade 8.
- Algebra should be consistently understood in terms of the “Major Topics of School Algebra,” as defined by the National Math Panel.
- The Major Topics of School Algebra include Symbols and Expressions; linear equations; quadratic equations; functions; algebra of polynomials; and combinatorics and finite probability.

### **Student Effort Is Important**

Much of the public's "resignation" about mathematics education is based on the erroneous idea that success comes from inherent talent or ability in mathematics, not effort. A focus on the importance of effort in mathematics learning will improve outcomes. If children believe that their efforts to learn make them "smarter," they show greater persistence in mathematics learning.

### **Importance of Knowledgeable Teachers**

- Teachers' mathematical knowledge is important for students' achievement. The preparation of elementary and middle school teachers in mathematics should be strengthened. Teachers cannot be expected to teach what they do not know.
- The use of teachers who have specialized in elementary mathematics teaching could be an alternative to increasing all elementary teachers' mathematics content knowledge by focusing the need for expertise on fewer teachers.

### **Effective Instruction Matters**

- Teachers' regular use of formative assessments can improve student learning in mathematics.
- Instructional practice should be informed by high-quality research, when available, and by the best professional judgment and experience of accomplished classroom teachers.
- The belief that children of particular ages cannot learn certain content because they are "too young" or "not ready" has consistently been shown to be false.
- Explicit instruction for students who struggle with math is effective in increasing student learning. Teachers should understand how to provide clear models for solving a problem type using an array of examples, offer opportunities for extensive practice, encourage students to "think aloud," and give specific feedback.
- Mathematically gifted students should be allowed to accelerate their learning.
- Publishers should produce shorter, more focused and mathematically accurate mathematics textbooks. The excessive length of some U.S. mathematics textbooks is not necessary for high achievement.

### **Effective Assessment**

The National assessment of Educational Progress (NAEP) and state assessments in mathematics should be improved in quality and should emphasize the most critical knowledge and skills leading to Algebra.

### **Importance of Research**

The nation must continue to build the capacity for more rigorous research in mathematics education to inform policy and practice more effectively.

For more information, please visit [www.ed.gov/mathpanel](http://www.ed.gov/mathpanel).