Overview

- Major initiative of the U.S. Department of Education
- Builds on research reviews by IES, Practice Guides, National Math Panel
- Builds a bridge from research to action

Current Math Topics

- Math and Science
  - Encouraging Girls in Math and Science
  - National Math Panel Report: Major Topics of School Algebra
Other Topics

- Psychology of Learning
  - How to Organize Your Teaching
- School Improvement
  - Turning Around Chronically Low-Performing Schools
- Early Childhood Education
  - Preschool Language and Literacy
- English Language Learners
  - Literacy in English K-5
Doing What Works

Educators across the nation are helping students be proficient in math and reading by 2014.

We can help. Learn how.

Featured Content

How to Organize Your Teaching
Teachers want their students to learn, to be able to apply their knowledge and skills in new contexts, and to remember what they learn over days, weeks, and months. Cognitive scientists, who study learning, have identified principles for reaching these goals.

Learn about teaching strategies to develop students’ understanding of key concepts and help them retain this knowledge.

Inside Classrooms
Selected Highlights

Take a look
Watch this guided tour of features found on this site!
National Math Panel: Critical Foundations for Algebra

In April 2006, the National Mathematics Advisory Panel was created to review the scientific evidence on mathematics teaching and learning, and to recommend ways to foster greater knowledge of and improved performance in mathematics among American students. The Panel set forth important messages for improving mathematics education to better prepare students for entry into algebra, including streamlining the mathematics curriculum to focus on a coherent set of critical foundation skills for pre-kindergarten to grade 8 students.

Select this topic to:

- Review the research base
- Understand the essentials
- Find recommended practices
- Access planning templates
National Math Panel: Critical Foundations for Algebra

The National Mathematics Advisory Panel (NMP) Final Report and Reports of the Task Groups and Subcommittees

The National Mathematics Advisory Panel conducted a systematic and rigorous review of the best available scientific evidence for the teaching and learning of mathematics and provided recommendations that lay out concrete steps to improve mathematics education, with a specific focus on preparation for learning algebra. The Panel worked in task groups and subcommittees to address areas of mathematics teaching and learning including Conceptual Knowledge and Skills, Learning Processes, Instructional Practices, Teachers and Teacher Education, and Assessment. Five task groups carried out detailed syntheses of research evidence that addressed each group’s major questions and met standards of methodological quality. Three subcommittees were charged with completion of a particular advisory function for the Panel. The research findings cited in these reports underpin the mathematics practices and content included on the Doing What Works website.

Link to Research Review

These three comprehensive planning templates include the three practices for National Math Panel: Critical Foundations for Algebra. An overview describes how these planning templates can be used by a technical assistance provider or other support provider working with districts and schools on improving the mathematics program.

Overview of Planning Templates
Critical Foundations for Algebra

The National Mathematics Advisory Panel report offers recommendations for how we can best prepare elementary and middle school students for success in algebra, a gateway to mathematics in high school and beyond.

Mathematics Preparation for Algebra
- Follow a focused, coherent progression of mathematics
- Achieve proficiency with whole numbers, fractions, and aspects of geometry and measurement
- Build deep understanding
- Emphasize fractions and related concepts

Comprehensive Instruction
- Develop conceptual understanding, computational fluency, and problem-solving skills
- Achieve automaticity in computation
- Provide adequate practice
- Encourage effort and persistence

Mastery Framework
- Set benchmarks for key skills
- Use formative assessments
- Provide explicit instruction for struggling students
- Offer acceleration and enrichment for gifted students

Grade-Level Benchmarks for Critical Foundations*

<table>
<thead>
<tr>
<th>Grade</th>
<th>Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE-K</td>
<td>Add and subtract whole numbers</td>
</tr>
<tr>
<td>K</td>
<td>Identify, represent, and compare fractions and decimals</td>
</tr>
<tr>
<td>1ST</td>
<td>Multiply and divide whole numbers</td>
</tr>
<tr>
<td>2ND</td>
<td>Compare, add, and subtract fractions and decimals</td>
</tr>
<tr>
<td>3RD</td>
<td>Solve problems with perimeter and area</td>
</tr>
<tr>
<td>4TH</td>
<td>Multiply and divide fractions and decimals</td>
</tr>
<tr>
<td>5TH</td>
<td>Use all operations on integers</td>
</tr>
<tr>
<td>6TH</td>
<td>Analyze properties and measures with 2- and 3-D shapes</td>
</tr>
<tr>
<td>7TH</td>
<td>Use all operations on positive and negative fractions</td>
</tr>
<tr>
<td>8TH</td>
<td>Solve problems with percent, ratio, rate, and proportion</td>
</tr>
<tr>
<td></td>
<td>Relate similar triangles with slope of a line</td>
</tr>
</tbody>
</table>

* For full report, including text for the benchmarks, please see: www.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf

Doing What Works
U.S. Department of Education

dww.ed.gov
For each practice:

- Research base/Instructional presentations
- Expert interviews

- School site videos and slide shows
- Interviews and sample materials from schools

- Tools and templates to implement practices

Learn What Works
Understand the research-based recommendation to teach vocabulary.

See How it Works
Explore how actual schools are teaching vocabulary.

Do What Works
Use a collection of tools and ideas to help you improve your practice.
Mathematics Preparation for Algebra

Use the icons above to navigate within each practice.

Practice Overview

Prepare students for entry into algebra by developing a focused, coherent progression of key topics and skills, including fractions, leading to proficiency.

Students who develop a strong understanding of key mathematics concepts and procedural fluency, and can use these competencies to solve problems, are better prepared for entry into algebra. more >>

What the research has shown
The Mathematics Preparation for Algebra practice is based on research evidence cited in the National Mathematics Advisory Panel Final Report and, in particular, the Task Group reports on Conceptual Knowledge and Skills and Learning Processes. more >>

Preparing Students for Success in Algebra

Use this multimedia overview to learn about the critical foundations needed to help all students become proficient in algebra. The importance of using a focused, coherent progression of key mathematics skills and concepts in the elementary and middle years. (8:37 min)

Start Presentation

Download Transcript & Details

Expert Interviews

The Critical Foundations of Success (Dr. Jay) Fortney, PhD, McDaniel College

Member, National Mathematics Advisory Panel; Chair, Conceptual Knowledge and Skills Task Group and Member, National Survey of Algebra 1 Teacher Subcommittees and Assessment Task Group

Dr. Fortney discusses the critical foundations, provides a detailed explanation of each of the essential skills and examples, and describes the progression of skill development, and talks about why it’s important for students to understand how mathematics works. (8:40 min)
Developing proficiency in fractions means: being able to represent and compare fractions, decimals, and percents, and understand the relationships among them. This includes being able to work with negative fractions and the ability to locate positive and negative fractions on a number line.

represent and compare
fractions
decimals
percents

3/5
.6
60%
Northridge Elementary School

Details
Where: Highlands Ranch, Colorado
Type: Suburban
District: Douglas County
Grade Level: Elementary (K-6)
Demographics: 77% White, 10% Asian, 10% Hispanic, 2% Black
6% Free or Reduced-Price Lunch
(=Colorado Department of Education, data from 2006-07 school year)
Contact: Elizabeth Morris, Principal

Link to Website

Highlights
Douglas County Schools have developed K-12 Essential Learnings to focus on the most important "checkpoints" and ensure that students are mastering key topics and skills. The elementary school demonstrates these features:

- Understanding algebra as the generalization of arithmetic, and
- Using manipulatives and visual representations to teach conceptual understanding of fractions.

Summary of Approach
Practices covered:

- Mathematics Preparation for Algebra
- Comprehensive Instruction

Northridge is a year-round school and one of the most diverse school in the Douglas County district with the third largest case load of English learners among the 38 elementary schools. All schools in the district follow the same mathematics K-8 Essential Learnings and checkpoints (based on NCTM Focal Points and Colorado standards) but have flexibility in choosing curricular materials.

Site Selection Criteria

Schools profiled for the National Math Panel: Critical Foundations for Algebra must meet the following criteria:

- Schools must demonstrate student achievement in mathematics that meets the requirements of adequate yearly progress under No Child Left Behind.

In addition, the school must meet two of the following criteria:

1. The pre-K-9 mathematics curriculum focuses on a limited number of key critical topics and prepares students for success in algebra. This is measured through a review of the school/district scope and sequence for mathematics focusing on fluency with whole numbers, algorithms, problem solving, and fractions as well as aspects of measurement and geometry that prepare students for algebra.

2. The student achievement in mathematics, as measured by valid and reliable instruments, shows higher levels of student performance at the advanced and proficient levels than state averages. This is measured through a review of school/district achievement data as reported to the state department of education for purposes of meeting adequate yearly progress under No Child Left Behind.

3. The school or district (depending on grade configuration) shows 50% or more students enrolled in algebra at the eighth-grade level and an increasing proportion enrolled and demonstrating success over the past 2-3 years. A review of student achievement and enrollment data shows an increase in the proportion of students taking Algebra I at the eighth grade level.
Doing What Works

Reviewing Student Work
Madison Elementary School (WA)

Listen to a roundtable discussion among principal and teachers as they use a protocol to review student work and determine next steps for instruction. Download the Protocol for Reviewing Student Work that is followed in the video.

(7:46 min)

Download Video
Quicktime | 55.5 MB | 7:46 min

Download Transcript & Details
PDF | 175 KB

Protocol for Reviewing Student Work
Madison Elementary School, Washington

SPEED Collaborative Protocol

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Problem Introduced. Participants listen and record thinking about the content of the problem. Participants should think about how they might go about solving the problem.</td>
<td>2 min</td>
</tr>
<tr>
<td>2</td>
<td>Begin looking at Student Sample #1 response to the problem. Move around the table sharing what math content does the student know and understand. Teachers can state the content and name the evidence in the sample.</td>
<td>2 min</td>
</tr>
<tr>
<td>3</td>
<td>Now move around the table sharing what math content is missing, or what misconceptions can be seen. Teachers can state the content and name the evidence in the sample.</td>
<td>2 min</td>
</tr>
<tr>
<td>4</td>
<td>Move to a collaborative discussion of possible strategies or types of intervention to use with the student. Possible resources can also be shared. Participants can personally record suggestions.</td>
<td>6 min</td>
</tr>
<tr>
<td>5</td>
<td>Now move to Student Sample #2 of the same problem. Repeat steps 2-4 for each new piece of student work presented.</td>
<td>10 min per student sample</td>
</tr>
<tr>
<td>6</td>
<td>After all Student Samples are discussed, use a table whip around protocol, each participant is asked to give a strategy or intervention they are thinking that might be successful for one of the students. Also take this time to share instruction leaves and resources.</td>
<td>2-5 min</td>
</tr>
<tr>
<td>7</td>
<td>The facilitator brings the protocol to a close. The group processed the protocol for its effectiveness and other suggestions.</td>
<td>2 min</td>
</tr>
</tbody>
</table>
**Practice Tools**

These tools help you use the materials in the "Learn What" and "Do the hard work of school improvement. Each tool is a down that you can edit and adapt to serve your needs.

**Learning Together About Mathematics Preparation**

Use this tool to guide district and school mathematics leaders as of the National Mathematics Advisory Panel report and systematic implications for systemwide changes.

**Moving Toward the Focused Curriculum**

Study how three different districts have moved toward a more focused curriculum and consider which of their approaches are useful for

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**Benchmarks Review Grid**

Use this grid below to determine the degree to which the benchmarks recommended in the National Mathematics Advisory Panel are currently addressed in the standards, mathematics curriculum, and assessments used to measure progress toward mastery. In columns 2, 3, and 4 code the specific standards, chapters in curriculum materials and units in a scope and sequence, and key points of assessment, including name of assessment and number of items. Remember that benchmarks are points of mastery so that the grade represented is an endpoint of proficiency that may be developed (and therefore represented in standards, curriculum, assessments) over several years.

<table>
<thead>
<tr>
<th>Benchmarks</th>
<th>Representation in Standards</th>
<th>Topic Coverage in Core Curriculum</th>
<th>Assessment for Mastery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fluency with Whole Numbers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By the end of Grade 3, students should be proficient in the addition and subtraction of whole numbers.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By the end of Grade 5, students should be proficient with multiplication and division of whole numbers.</td>
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<td></td>
</tr>
<tr>
<td><strong>Fluency with Fractions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By the end of Grade 4, students should be able to identify and represent fractions and decimals, and compare them on a number line or with other common representations of fractions and decimals.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By the end of Grade 6, students should be proficient with comparing fractions and decimals and common percents, and with the addition and subtraction of fractions and decimals.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By the end of Grade 6,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AREA OF LEA RESPONSIBILITY</td>
<td>CURRENT STATUS</td>
<td>NEXT STEPS</td>
<td>DWW RESOURCES (LINKS TO SPECIFIC RESOURCES)</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------</td>
<td>------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td><strong>B. Setting Standards and Expectations for Achievement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. LEA articulates to all staff the same learning outcome expectations in critical foundations for algebra for all students.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. District-adopted mathematics standards and benchmarks, augmenting state standards as necessary, address mathematical proficiency for critical foundations for algebra at all grade levels.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. LEA communicates a coherent mathematical curriculum emphasizing foundational skills and expectations for all students for the learning of algebra.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Do the practices - use tools to help you reflect on your school's mathematics program, support classroom teachers, and improve instruction.

**Doing What Works**

dww.ed.gov