The Impact of the Common Core Mathematics Standards

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Major Shifts

- Focus—narrower and deeper
- Coherence—across grade levels; link topics within a grade
- Rigor—balance among conceptual understanding, procedural fluency, application
- Standards for Mathematical Practice
Focus

• Significantly narrow the scope of content and deepen how time and energy is spent in the math classroom

• Focus deeply only on what is emphasized in the standards so that students gain strong foundations
Traditional U.S. Approach

Number and Operations

Measurement and Geometry

Algebra and Functions

Statistics and Probability
CCSSM approach–Number & Operations

Operations and Algebraic Thinking

Number and Operations—Base Ten

Number and Operations—Fractions

Expressions and Equations

The Number System

Algebra

K 1 2 3 4 5 6 7 8 High School
## Content Foci by Grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Priorities for Fluency and Conceptual Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>K–2</td>
<td>Addition and subtraction, measurement using whole number quantities</td>
</tr>
<tr>
<td>3–5</td>
<td>Multiplication and division of whole numbers and fractions</td>
</tr>
<tr>
<td>6</td>
<td>Ratios and proportional reasoning; early expressions and equations</td>
</tr>
<tr>
<td>7</td>
<td>Ratios and proportional reasoning; arithmetic of rational numbers</td>
</tr>
<tr>
<td>8</td>
<td>Algebra–linear equations</td>
</tr>
</tbody>
</table>
High School

- **Number & quantity**
  - Real number system
  - Complex number system
  - Vector & matrix quantities

- **Algebra**
  - Seeing structure in expressions
  - Arithmetic with polynomials and rational expressions
  - Reasoning with equations and inequalities
High School, cont’d.

- **Functions**
  - Interpreting function
  - Building functions
  - Linear, quadratic, trigonometric, and exponential

- **Geometry**
  - Congruence
  - Similarity, right triangles, trigonometry
  - Expressing geometric properties with equations
  - Geometric measurement and dimension
  - Geometric modeling
High school, cont’d.

- **Statistics and probability**
  - Interpreting categorical & quantitative data
  - Making inferences & justifying conclusions
  - Conditional probability & the rules of probability
  - Using probability to make decisions
- **Modeling**
Coherence

- Carefully connect the learning within and across grades so that students can build new understanding onto foundations built in previous years.

- Teachers can begin to count on solid conceptual understanding of core content and build on it. Each standard is not a new event for students but an extension of previous learning.
Rigor

- The CCSSM require a balance of:
  - Solid conceptual understanding
  - Procedural skill and fluency
  - Application of skills in problem solving situations

- This requires equal intensity in time, activities, and resources in pursuit of all three
Standards for Mathematical Practice

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.
Implications for college content courses

- CCSSM requires that students complete precalculus in high school.
- Need articulation between HS and college
- What is the future of developmental mathematics, college algebra, mathematical modeling, the mathematics of decision-making, and precalculus?
- Will we need more remedial classes or fewer?
- How/when will we know?
- What do our placement tests tell us? How confident are we in them? How do they align with CCSSM?
Alternatives

- What mathematics does a non-STEM major need in college if s/he has completed a rigorous precalculus course in high school?
  - Quantitative literacy
  - Integrated STEM course based on engineering tasks
  - Other options that do not lead to calculus?

- This may not seem like “our” problem, but
  - We have insights to offer.
  - Some teacher education students take these classes, too.
  - High school teachers don’t expect their students to have to repeat their courses in college.
Pedagogical implications

- **Students should come to us**
  - Having engaged regularly in the mathematical practices
  - Used to working in groups
  - Used to explaining their thinking, verbally and in words
  - Proficient in using technology to explore mathematical ideas

- **How does our pedagogy build on this?**
  - Need/opportunity for professional development for higher ed faculty
Up the ante

- Our preservice teachers should be prepared for rigorous courses in college
- How does this affect courses for teachers?
Implications for Teacher Education

- **Content courses for teachers**
  - Need to ensure teachers are proficient with content of CCSSM...probably 2-3 grades beyond what they will teach
  - Teachers need to see the mathematical horizon of topics
  - Quantitative literacy/statistics, especially in middle school
  - Content courses for secondary teachers; middle grades content for secondary teachers
  - Teachers need to engage in the mathematical practices
Implications for Teacher Education

- **Pedagogy**
  - Representations
  - Methods
  - Student learning progressions
  - Curriculum progressions
  - Standards for mathematical practice
Inservice Teacher Education

- There is and will continue to be a tremendous need for inservice teacher education/professional development
- Does not have to be graduate programs
- Collaboration among Arts & Sciences and Education with school partners is crucial.
Those of us in higher ed cannot continue to use the same tasks and activities we have always used.

We need to dig into the Common Core and align our work with it.
Challenges

- Curriculum materials are lagging implementation
- Assessment is lagging implementation
- Assessment is a scary unknown