FREE WEBINAR: MATH PRACTICES AND THE Common Core
Erik Robelen
Assistant editor, *Education Week*
Math Practices and the Common Core

**Expert Presenters:**

Jason Zimba, co-founder, Student Achievement Partners and a lead writer of the common standards in mathematics

Marlene Lovanio, math supervisor, Bristol school district, Conn.
An on-demand archive of this webinar will be available at www.edweek.org/go/webinar in less than 24 hrs.
Mathematical Practices and the Common Core

Jason Zimba
Student Achievement Partners
www.achievethecore.org
Student Achievement Partners principles –

• **We hold no intellectual property**
  – Our goal is to create and disseminate high quality materials as widely as possible. All resources that we create are open source and available at no cost. We encourage states, districts, schools, and teachers to take our resources and make them their own.

• **We do not compete for state, district or federal contracts**
  – Ensuring that states and districts have excellent materials for teachers and students is a top priority. We do not compete for these contracts because we work with our partners to develop high quality RFPs that support the Core Standards.

• **We do not accept money from publishers**
  – We work with states and districts to obtain the best materials for teachers and students. We are able to independently advise our partners because we have no financial interests with any publisher of education materials. Our independence is essential to our work.
These Standards are not intended to be new names for old ways of doing business. They are a call to take the next step.

CCSSM, p. 5
The Three Shifts in Mathematics

Focus strongly where the Standards focus

Coherence: Think across grades, and link to major topics within grades

Rigor: In major topics, pursue with equal intensity:
- Conceptual understanding
- Procedural skill and fluency
- Application
The Importance of **Focus**

*Less topic coverage* [in high-performing countries] can be associated with *higher scores* on those topics covered because students have more time to master the content that is taught.  

—Ginsburg et al., 2005

This finding that *postsecondary instructors target fewer skills* as being of high importance is consistent with recent policy statements and findings raising concerns that some states require too many standards to be taught and measured... ...states would likely benefit from examining their state standards and, where necessary, reducing them to **focus only on the knowledge and skills that research shows are essential** to college and career readiness and postsecondary success. ...

—ACT National Curriculum Survey 2009

...*[B]ecause conventional textbook coverage is so fractured, unfocused, superficial, and unprioritized*, there is no guarantee that most students will come out knowing the essential concepts of algebra.  

—Wiggins, 2012
Connecting Content Standards and Practice Standards

“The standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle, and high school years.”

“Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction.” (CCSSM, pg. 8)
Connecting Content Standards and Practice Standards

• Practice standards combine easily and a single student behavior could be thought of as exhibiting multiple practice standards at once.
  – Not a checklist

• Practice standards change through the grades as students grow in mathematical maturity and in the sophistication with which they apply mathematics.
  – Need to ensure grade-level appropriate expectations
MP.7: Look for and make use of structure.

Illustrative task: *Comparing Products*

Leo and Silvia are looking at the following problem:

How does the product of $60 \times 225$ compare to the product of $30 \times 225$?

Silvia says she can compare these products without multiplying the numbers out. Explain how she might do this. Draw pictures to illustrate your explanation.

Source: Illustrative Mathematics (http://illustrativemathematics.org/)
Patterns are a tool, not a topic.

MP.8: Look for and express regularity in repeated reasoning.

Students are given pairs of addition problems like

- 5+6=?
- 5+7=?
- 3+5=?
- 4+5=?
- 7+7=?
- 8+7=?

Students are asked to describe what they notice and formulate a general statement, e.g., “When you increase one of the addends by 1 then you increase the entire sum by 1.” In later grades, this can be formulated as a special case of properties, \(a + (b+1) = (a+b) + 1\) or \((a+1) + b = (a+b) + 1\).

Patterns are a tool, not a topic.

MP.8: Look for and express regularity in repeated reasoning.

An illustration from a teacher professional development activity

(a) Show how to cut up a 12 by 16 rectangle to fit inside a square with the same perimeter. Use your method on an 8 by 14 rectangle. Then a 5 by 13. In each case, how much area is left over?

(b) Show that any rectangle can be cut up and fit into a square with the same perimeter. Describe precisely how much is left over.

The transition from (a) to (b) might be carried out by noticing regularity in the results. But a deeper analysis comes from the regularity in the calculations---doing it enough times until you get the rhythm of what you are doing, independent of any specific numerical inputs, and being able to express the rhythm in precise language.
MP.3: Construct viable arguments and critique the reasoning of others
Mathematical Reasoning is a Refrain in the Content Standards

Use place value understanding and properties of operations to add and subtract.

4. Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.

5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.

6. Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

Note generally such words as justify a conclusion, prove a statement, explain the mathematics; also derive, assess, illustrate, and analyze.
• Tasks targeting MP.3 can (and often should) have fine “grain size.”

• The Standards ask students not just to Reason, but to “reason about X,” where X is key grade-level mathematics such as properties of operations, relationships between addition and subtraction or between multiplication and division, fractions as numbers, variable expressions, linear/nonlinear functions, etc.
Amber didn’t know what $7 \times 5$ equals, but she knew $5 \times 5 = 25$ and $2 \times 5 = 10$. Use drawings, words, and/or equations to explain why Amber can add 25 and 10 to find what $7 \times 5$ equals.
Focus and Coherence

• **Focus** to make practice standards attainable.
• Use practices as a **vehicle** for focus and coherence:
• **Purposely connect practices with strong content emphases in the standards** such as properties of operations, place value decompositions of numbers, numerators and denominators of fractions, numerical and algebraic expressions, etc.
Additional Resources

• Progressions document
  www.tinyurl.com/mathprogressions

• Illustrative Math Project
  www.illustrativemathematics.org

• PARCC
  www.parcconline.org

• Smarter Balanced
  www.smarterbalanced.org

• NCTM Core Math Tools (interactive software tools)
  www.nctm.org
DreamBox Learning Math
Rigorous Adaptive Elementary Mathematics
The “right” learning environment
Evidence-based methodology
Rigorous math curriculum
Aligned to Common Core State Standards
Engaging gaming technology

Intelligent Adaptive Learning™
Click-by-click monitoring
On-the-fly learning path revision

True mastery.
Implementing the Common Core Standards for Mathematical Practice

Education Week Webinar

Marlene Lovanio
Supervisor of Mathematics
Bristol Public Schools
A Picture of Bristol

- Student population - 8613
  - 42% Free/reduced lunch
  - 26% Minority

- Schools
  - 6 elementary schools
  - 2 K-8 schools
  - 2 middle schools
  - 2 high schools
Bristol’s Plan

2010 – 2013
Curriculum Revision & Materials Alignment/Purchase

2011 – 2014
Implementation

2011 – 2012
Introduce and Apply Mathematical Practice Standards

2014 -2015
New Assessment Smarter Balanced Assessment Consortium

Summer 2010
State Curriculum and Sample Task Development
Introducing the Standards for Mathematical Practice K-12

• Unpacking the standards
• Creating a vision – what does it look like?
• Making a commitment
  – Problem solving
  – Constructing arguments
  – Modeling
CLASSROOM STRATEGY: POSE MEANINGFUL TASKS
Not only this
Identify each number as prime or composite.

but also ...

Which one is different? Why?

Find more than one possible answer.

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.
Not only this

Find 20% of 350,000.

but also ...
A fast food chain reports that 8% of people in the U.S. eat at its restaurants each day. The fast food chain has 12,800 stores. According to the 2010 Census Bureau report approximately 310 million people live in the U.S..

Make a conjecture as to whether or not you believe the report from the fast food chain to be accurate. Create a mathematical argument that validates your conclusion...

**Mathematical Practices**

1. Make sense of problems and persevere in solving them.
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8. Look for and express regularity in repeated reasoning.
Not only this

A rectangle has side lengths of 7 m and 9 m. A square with side length 5 m is cut out of the rectangle. Find the area of that rectangle after the square is cut out.

but also...
Below is a satellite photo of Geoff’s yard. He is interested in re-sodding his entire yard. Help him out by providing a cost estimate.

Develop a list of questions you would need answered before you can solve the problem.

Contributed by Bristol Central Geometry Teachers
Other Strategies to Promote the Practices

• Shift the locus of mathematical control
• Develop perseverance
• Increase opportunities for communication
• Ask higher-order questions
• Seek multiple solutions/representations
• Attend to vocabulary
• Make connections within and across mathematics
## Universal Tools: Teacher Guides

### Mathematically Proficient Students

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>![Image 1]</td>
<td>![Image 2]</td>
<td>![Image 3]</td>
<td>![Image 4]</td>
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Universal Tools: Classroom Posters

- Make sense of problems and persevere 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

Bristol Math PRACTICES for success
<table>
<thead>
<tr>
<th>Lesson Components</th>
<th>What the teacher is doing...</th>
<th>What the students are doing...</th>
<th>Assessment of learning</th>
</tr>
</thead>
</table>
| Instructional Delivery (15-20 min.) | •Providing opportunities to move between diff. representations  
•Introducing new vocabulary and utilizing the word wall  
•Facilitating discussions, noting key ideas and uncovering misconceptions | •Asking questions to clarify and deepen understanding  
•Participating and actively listening to discussions  
•Sharing strategies and solutions | •Listening and probing further  
•Using quick-checks to gauge student understanding |
Universal Tools: District Curriculum

• Arizona Explanations and Examples
• Instructional Strategies
  – “Have students compare their answers and describe why answers are reasonable to the rest of the class.”
• Common Learning Experiences
  – Student centered activities
  – Investigations
  – Performance tasks
    • Fractional Edge Length Performance Task (CSDE)
Is it on the test?

<table>
<thead>
<tr>
<th>Claim 2: Problem Solving</th>
<th>Grade: HS</th>
<th>Comparison to Traditional State Test Item(s)</th>
</tr>
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<tbody>
<tr>
<td><strong>Item Stem</strong></td>
<td></td>
<td>This item integrates content from across grades, a feature not very prevalent in existing assessment items, which are often designed with specific grade level focus. Students’ understanding of each topic below contributes to his/her success in solving this problem:</td>
</tr>
</tbody>
</table>
| A circle has center at (6, 7) and goes through the point (1, 4). Give the coordinates for the center of a circle that is tangent to the first at the point (1, 4) and half the area. Show your work or explain how you got your answer. |          | • Area of circle (Grade 7)  
• All circles are similar (HS)  
• Using similar triangles to understand slope (Grade 8)  
• Equation of a circle (HS)  
• Definition of tangent (HS) |

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<th>Adaptive Versions</th>
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<td>Lower difficulty by replacing the &quot;half the area&quot; with &quot;same area.&quot;</td>
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Source: Smarter Balanced Assessment Consortium Supplemental Samples
Running into Roadblocks

• Time for professional development
• Time for planning
• Time for teaching
• Beliefs about teaching math
• Programs
• Content knowledge
My Top 5 List


• Illustrative Mathematics Project - http://illustrativemathematics.org/standards/hs

• CCGPS resource collection - https://ccgps.org/

• dy/dan - Dan Meyer’s blog - http://blog.mrmeyer.com/
Increasing Math Achievement
with Intelligent Adaptive Learning™ Technology
DreamBox Combines Three Essential Elements to Accelerate Student Learning

**Rigorous Elementary Mathematics**
- Common Core State Standards
- Standards for Mathematical Practice

**Intelligent Adaptive Learning™ Engine**
- Millions of individualized learning paths
- Tailored to a student’s unique needs

**Motivating Learning Environment**
- Student directed, empowering
- Gaming fundamentals, rewards
Increasing Math Achievement in Schools Across the Country

Rocketship Education, CA
• SRI international study found students increased 5.5 percentile points after just 21 hours on DreamBox

West Seattle Elementary, WA
• Highest growth in math test scores in school district
• Made AYP in Math for the first time in 5 years

Howard County Public Schools, MD
• High achieving school district takes math scores from good to great
To learn more about DreamBox

Visit [www.dreambox.com/ew-webinar](http://www.dreambox.com/ew-webinar) or email us at [schools@dreambox.com](mailto:schools@dreambox.com)
An on-demand archive of this webinar will be available at www.edweek.org/go/webinar in less than 24 hrs.
Math Practices and the Common Core

Required Reading from *Education Week*:

**Special Report: Math, Literacy and Common Standards**
Nearly every state has signed on to use the Common Core State Standards as a framework for teaching English/language arts and mathematics to students. This report examines the progress some states have made in implementing the standards, what preparations need to be undertaken, and the challenges that policymakers and educators face in achieving the goals of the standards.

**Spotlight on Implementing Common Standards**
In order to implement the Common Core State Standards, educators need instructional materials and assessments. But not all states are moving at the same pace, and some districts are finding common-core resources in short supply. This Spotlight highlights the curriculum, professional development, and online resources available to help districts prepare for the common core.
Road Maps to
COMMON CORE Success

REGISTRATION NOW OPEN!

INDIANAPOLIS
March 11, 2013

WHITE PLAINS
March 21, 2013

www.edweekevents.org/common-core-success