IDENTIFYING ‘RIGOR’: District Strategies For Transitioning to the Common Core in Math

Sponsored by Think Through Math
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*managing editor, Education Week Teacher*

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Expert Presenters:

Ted H. Hull, mathematics-education consultant and co-author, *Realizing Rigor in the Mathematics Classroom*

Ruth Harbin Miles, K-12 mathematics instructional coach and co-author, *Realizing Rigor in the Mathematics Classroom*
An on-demand archive of this webinar will be available at www.edweek.org/go/webinar in less than 24 hrs.
Identifying Rigor: District Strategies for Transitioning to the Common Core in Math

Ted H. Hull
Pflugerville, Texas

Ruth Harbin Miles
Madison, Virginia
Welcome
Purposes of the Webinar

• Clarify the significance of the CC Standards for Mathematical Practice

• Explain the need for instructional balance

• Define mathematical rigor in useable terms
Purposes of the Webinar

• Identify that working to implement the Practices unites many issues

• Emphasize the role of administrators and instructional leaders
Organization of the Webinar

Part 1: Understanding the depth of the Common Core Standards for Mathematical Practice via the Proficiency Matrix

Question and Answer

Part 2: Understanding Mathematical Rigor

Question and Answer
Part 1
Understanding the depth of the Common Core Standards for Mathematical Practice via the Proficiency Matrix
Unification with the Practices

• Mathematical Rigor
• Effective Instructional Strategies
• Brain research
• Formative assessment
• Instructional balance
• Students’ mathematical success
Brain Research

• Time to make sense of the mathematics
• Interesting, engaging lessons
• Time to make connections
• Time to move short-term memory into long-term
Effective Instructional Strategies

• Engagement
• Motivation
• Collaboration
• Discourse
• Thinking and Metacognition
• Ongoing Formative Assessment
Statements on Balance

Mathematical Proficiency, NRC (2001):

• **conceptual understanding** – comprehension of mathematical concepts, operations, and relations, **AND**

• **procedural fluency** – skill in carrying out procedures flexibly, accurately, efficiently, and appropriately.
<table>
<thead>
<tr>
<th>Students:</th>
<th>(I) = Initial</th>
<th>(IN) = Intermediate</th>
<th>(A) = Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a Make sense of problems</td>
<td>Explain their thought processes in solving a problem one way. <em>(Pair – Share)</em></td>
<td>Explain their thought processes in solving a problem and representing it in several ways. <em>(Question/Wait time)</em></td>
<td>Discuss, explain, and demonstrate solving a problem with multiple representations and in multiple ways. <em>(Grouping/Engaging)</em></td>
</tr>
<tr>
<td>1b Persevere in solving them</td>
<td>Stay with a challenging problem for more than one attempt. <em>(Question/Wait time)</em></td>
<td>Try several approaches in finding a solution, and only seek hints if stuck. <em>(Grouping/Engaging)</em></td>
<td>Struggle with various attempts over time, and learn from previous solution attempts. <em>(Show Thinking)</em></td>
</tr>
<tr>
<td>2 Reason abstractly and quantitatively</td>
<td>Reason with models or pictorial representations to solve problems. <em>(Grouping/Engaging)</em></td>
<td>Are able to translate situations into symbols for solving problems. <em>(Grouping/Engaging)</em></td>
<td>Convert situations into symbols to appropriately solve problems as well as convert symbols into meaningful situations. <em>(Encourage Reasoning)</em></td>
</tr>
<tr>
<td>3a Construct viable arguments</td>
<td>Explain their thinking for the solution they found. <em>(Show Thinking)</em></td>
<td>Explain their own thinking and thinking of others with accurate vocabulary. <em>(Question/Wait time)</em></td>
<td>Justify and explain, with accurate language and vocabulary, why their solution is correct. <em>(Grouping/Engaging)</em></td>
</tr>
<tr>
<td>3b Critique the reasoning of others.</td>
<td>Understand and discuss other ideas and approaches. <em>(Pair – Share)</em></td>
<td>Explain other students’ solutions and identify strengths and weaknesses of the solution. <em>(Question/Wait time)</em></td>
<td>Compare and contrast various solution strategies and explain the reasoning of others. <em>(Grouping/Engaging)</em></td>
</tr>
<tr>
<td>4</td>
<td>Model with Mathematics</td>
<td>Use models to represent and solve a problem, and translate the solution to mathematical symbols. <em>(Grouping/Engaging)</em></td>
<td>Use models and symbols to represent and solve a problem, and accurately explain the solution representation. <em>(Question/Prompt)</em></td>
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<tr>
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<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Use appropriate tools strategically</td>
<td>Use the appropriate tool to find a solution. <em>(Grouping/Engaging)</em></td>
<td>Select from a variety of tools the ones that can be used to solve a problem, and explain their reasoning for the selection. <em>(Grouping/Engaging)</em></td>
</tr>
<tr>
<td>6</td>
<td>Attend to precision</td>
<td>Communicate their reasoning and solution to others. <em>(Show Thinking)</em></td>
<td>Incorporate appropriate vocabulary and symbols when communicating with others. <em>(Allowing Struggle)</em></td>
</tr>
<tr>
<td>7</td>
<td>Look for and make use of structure</td>
<td>Look for structure within mathematics to help them solve problems efficiently (such as $2 \times 7 \times 5$ has the same value as $2 \times 5 \times 7$, so instead of multiplying $14 \times 5$, which is $(2 \times 7) \times 5$, the student can mentally calculate $10 \times 7$. <em>(Question/Prompt)</em></td>
<td>Compose and decompose number situations and relationships through observed patterns in order to simplify solutions. <em>(Allowing Struggle)</em></td>
</tr>
<tr>
<td>8</td>
<td>Look for and express regularity in repeated reasoning</td>
<td>Look for obvious patterns, and use if/ then reasoning strategies for obvious patterns. <em>(Grouping/Engaging)</em></td>
<td>Find and explain subtle patterns. <em>(Allowing Struggle)</em></td>
</tr>
</tbody>
</table>
The Standards for Mathematical Practice:

• are not superficial.
• require skill proficiency and conceptual understanding
• require a variety of instructional strategies.
Direct Teaching

Exploratory Teaching
Part 1 Conclusion
Roles for Leaders

• Collaborate with teachers and staff continually
• Establish and communicate clear expectations
• Require consistently that ANY expectations be for and about all students’ improvement
Leader Actions:

• Collect face-to-face and anonymous input.
• Search for patterns and trends for groups.
• Work with others to create a clearly articulated curriculum (over time).
• Ensure written, taught, and tested as specified by Common Core and directed by Practices.
WHAT IS THINK THROUGH MATH?

• For all students in grades 3 through Algebra I
• Web-based, adaptive math instruction and practice
• Designed to prepare students for the rigors of next generation Common Core and STAAR assessments
• Deepens student understanding
• Supports teacher effectiveness
• Proven effective
Q & A
PART 1
Part 2: Understanding Mathematical Rigor
Achieving Mathematical Rigor:

The Proficiency Matrix is a guiding tool, not an evaluation tool.

It is used:
• for lesson preparation.
• for lesson analysis and reflection.
• to build common expectations.
Rigor Definition

...the depth of interconnecting concepts and the breadth of supporting skills students are expected to know and understand.

Effective, ongoing interaction between instruction and student reasoning and thinking about concepts, skills, and challenging tasks that result in a conscious, connected, and transferable body of valuable knowledge for every student.

Content

Instruction
Premise

Teaching the Common Core content using the Standards for Mathematical Practice to reach progressively higher levels of proficiency attains mathematical rigor.
## Rigor Analysis Form

<table>
<thead>
<tr>
<th>Content</th>
<th>1 Not Evident Minimal, Skill-Based</th>
<th>2 Skill/Procedure Focus</th>
<th>3 Moderate Concept Inclusion</th>
<th>4 Concept Development Evident</th>
<th>5 High-Quality Content, Materials Incorporated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade-Level Appropriate</td>
<td></td>
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<tr>
<td>Related to Conceptual (Big Ideas)</td>
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<tr>
<td>Meaningful, Logical Flow Within Lesson</td>
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<tr>
<td>Connected to Prior/Future Component</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instruction</th>
<th>1 Not Evident Minimal, Skill-Based</th>
<th>2 Skill/Procedure Focus</th>
<th>3 Progress Toward Indicators Apparent</th>
<th>4 Students Participatory, Routines Apparent</th>
<th>5 High-Level Student Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaging</td>
<td></td>
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<td>Challenging Problems</td>
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<td>Interactive Discourse</td>
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<td>Knowledge Transfer</td>
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<tr>
<td>Open-Ended/Multiple Solution Paths</td>
<td></td>
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</tr>
<tr>
<td>Assessment</td>
<td>1 Not Evident, Did Not Occur</td>
<td>2 Skill, Procedure Focus</td>
<td>3 Problem Application</td>
<td>4 Performance Task</td>
<td>5 Authentic Real-life Problem</td>
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</tr>
<tr>
<td>Content Appropriate</td>
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<tr>
<td>Incorporates Thinking and Reasoning</td>
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<tr>
<td>Formative Assessment Within Classroom Period</td>
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<tr>
<td>Data Informs Instruction</td>
<td></td>
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<tr>
<td>Summative Assessment</td>
<td></td>
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<tr>
<td><strong>Climate</strong></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Everyone Involved</td>
<td>1 Teacher Dominated, Docile Students</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Enthusiasm Apparent</td>
<td>2 Teacher Controlled, Top-Tier Students Involved</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Positive Tone, Supportive</td>
<td>3 Participation Promoted, Students Engaged</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Self-Assurance, Effective Effort</td>
<td>4 Encouraging Pushing Thinking for All Students</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Community of Learners</td>
<td>5 Student Focused, Teacher Facilitated</td>
<td></td>
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</tr>
</tbody>
</table>
Monitoring for Rigor in Mathematics

• Content

• Instruction

• Assessment

• Climate
Classroom instruction must increase:

- Levels of students’ engagement
- Amount of students’ motivation
- Degree of students’ collaboration
- Depth of students’ discourse
- Significance of students’ thinking and metacognition
- Use of on-going formative assessment
Brief Example of Using the Rigor Analysis Form
Mathematics Classroom Lesson:

A. Accept the lesson

A. Adapt the lesson

A. Remove and create a replacement lesson
Part 2
Roles for Leaders

• Provide appropriate and regular professional development.
• Monitor for evidence of change and progress.
• Use data to drive decisions.
Leader Actions

• Build support, momentum, and critical mass by focusing on the willing first, and the almost willing next.

• Dig below the surface when identifying change initiatives.

• Commit to the change, and provide the required resources.
The Proficiency Matrix and Rigor Analysis Form are available to download for free on our website.

mathleadership.com
Thank you for your interest and involvement.

Ruth, Ted, & Don
A HISTORY OF RESEARCH

• Led by the U.S. Air Force Research Laboratory
• 10-year Study
• 30,000 Students
• Problem Solving Skills

• Grades 3 – Algebra I
• Two Million Plus Students
• Personalized Instruction
• Next Gen Assessment Types
• Live Certified Teachers
PROVEN EFFECTIVE

HILLSBOROUGH COUNTY STUDENTS OUTSCORE STATE PEERS
Hillsborough County Public Schools, TAMPA

COMPLETING >20 LESSONS INCREASES PROFICIENCY
Birdville Independent School District, FORT WORTH

74% IMPROVEMENT ON STAAR; 20% JUMP AMONG AFRICAN AMERICAN STUDENTS
Elgin Independent School District, AUSTIN

MEASURABLE RESULTS ACHIEVED WHEN STUDENTS COMPLETE > 20 LESSONS IN THEIR TARGETED PATHWAY
CHALLENGES

ALGEBRA FAILURE

DISENGAGED STUDENTS

OVERWHELMED TEACHERS
FORMULA FOR SUCCESS

Instant Access to Certified Common Core-trained Teachers

Actionable Reports

Adaptive Common Core Instruction

Ongoing Student Motivation
A MODEL FOR LEARNING

DATA-DRIVEN INSTRUCTION

Educators facilitate learning with actionable data

1:1 ADAPTIVE INSTRUCTION

Students complete 2 or 3 lessons weekly
WHO IS TTM FOR?

- Students who are working below grade-level (INTERVENTION)
- Students who are working at grade-level (PRACTICE)
- Students who are working above grade-level (ENRICHMENT)
- English language learners
- Special education students
- High school students at risk of dropping out
## IMPLEMENTATION OPTIONS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>TIME IN SYSTEM</th>
<th>SCENARIOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPPLEMENTAL Support for Core</td>
<td>2-3 45 minute sessions a week</td>
<td>– Blended Classroom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Computer Lab</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Test Prep</td>
</tr>
<tr>
<td>INTERVENTION</td>
<td>2-3 45 minute sessions a week</td>
<td>– Second Math Class</td>
</tr>
<tr>
<td>EXTENDED LEARNING</td>
<td>45 minutes a session</td>
<td>– Summer School</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– After School</td>
</tr>
</tbody>
</table>
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Required Reading from Education Week:

Spotlight on Math and the Common Core
The transition to the common-core math standards has resulted in shifts in classroom teaching and course materials. In this Spotlight, take a look at how the common core is influencing math instruction, see how teachers are preparing at-risk students for the standards, and examine early assessments aligned to the common core.