Mathematics and Special Education Leadership Protocols

Protocol 3:

Essential Understandings About Rigorous Mathematics Instruction

Developed in collaboration with the MA DESE, the MA Math Support Specialists' Network and Education Development Center, Inc.

Massachusetts Department of
ELEMENTARY & SECONDARY
EDUCATION

EDC Learning transforms lives.

Clarifying the Work of the Team

- 1: Shared Beliefs About Mathematics Instruction for Students with Disabilities
- 2: Essential Understandings About Students with Disabilities
- **3: Essential Understandings About Rigorous Mathematics Instruction**
- 4: Aligning Barriers and Strategies
- 5: *Responding to a Range of Learning Needs*

Protocol 3 Goals

- To establish a shared definition of “a rigorous mathematics experience for all students;”
- To become familiar with how the Standards for Mathematical Practice help deepen students’ understanding of content.

Agenda

- Brainstorming a Definition of "Rigorous Mathematics Experience for All Students"
- Examples of Increasing Mathematical Rigor
- Introduction to Standards for Mathematical Content integrated with the Standards for Math Practices (SMPs)
- Use Video to Better Understand Content Standard 7.EE.4 and Math Practice #3
- Establishing a Shared Definition of "Rigorous Mathematics"
- Wrap up, next steps

Examples of Increasing Mathematical Rigor

What characterizes those problems that are more rigorous?

How does that fit with your initial brainstormed definition of rigor?

Increasing the Mathematical Rigor

- 6 + 5 = _____
- What pairs of numbers add up to 11?
- What pairs can you find if you don't restrict yourself to whole numbers?
- How do you know you have them all?

Increasing the Mathematical Rigor

- Increasing the rigor does not necessarily mean going faster or going further ahead in the curriculum
- It means "going deeper"
- What do we mean by "going deeper?"

Increasing the Mathematical Rigor

What is the rule for finding the mean (or average) of a set of numbers?

Increasing the Mathematical Rigor

Find the mean (average) of the following set of eight numbers:

4, 6, 9, 5, 13, 12, 9, 10

Increasing the Mathematical Rigor

Find two different sets of eight numbers, each with a mean (average) of 8.5

(The numbers don't have to be integers.)

Increasing the Mathematical Rigor

The mean age of males in MA is 40.6 and the mean age of females in MA is 36.2.

Maria says that she has a shortcut for finding the mean age of all the people in MA:

"You just take the mean of 40.6 and 36.2. It's 38.4"

Is she correct? Why or why not?

Increasing the Mathematical Rigor

What is the area formula for a rectangle?

Increasing the Mathematical Rigor

Find the area for a rectangle with a length of 7 and a width of 3.

Increasing the Mathematical Rigor

What's the largest possible area of a rectangle that has a perimeter of 16 inches?

What's the smallest possible area?

Increasing the Mathematical Rigor

Given a rectangle with a fixed perimeter (i.e. the total perimeter is a particular length and that total length does not change), describe how the area changes as the length and width of the rectangle change.

Increasing the Mathematical Rigor

Rigor ≠

- doing more and doing it faster;
- heavier work load;

Rigor =

- going into greater depth;
- attending to learning and understanding concepts, not just completing procedures.

2011 MA Math Frameworks - 2 Key Parts

1) Standards for Mathematical Content

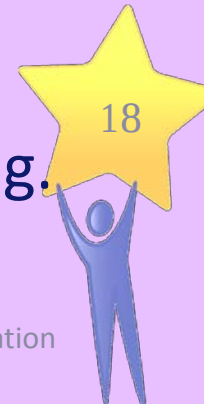
- K-8 standards presented by *grade level*
- Organized into domains that progress over several grades
- Grade intros give 2–4 focal points at each grade level
- High school standards presented by *conceptual category* (Algebra and Functions, Geometric Measurement, etc.)

2) Standards for Mathematical Practice

- Carry across all grade levels
- Describe habits of mind of a mathematically proficient student

Standards for Mathematical Practice

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.



The Math Content and Practice Standards

*"These Standards are **not intended to be new names for old ways of doing business**. They are a call to take the next step. It is time for states to work together to build on lessons learned from two decades of standards based reforms."*

-2011 Massachusetts Curriculum Framework for Mathematics (page 14)

These Math Practices Define the "Next Step!"

- They articulate how students must engage with the mathematics content in order to "reason like a mathematician", not just compute like a calculator.

Standards for Mathematical Practice

- *"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**."*

Page 18, *2011 Massachusetts Curriculum Framework for Mathematics*

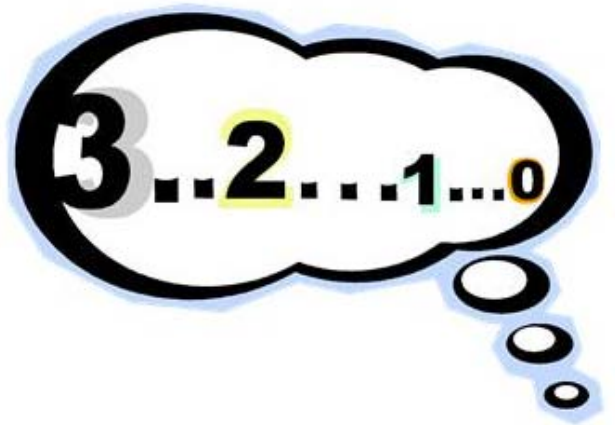
Getting Familiar with the Standards for Mathematical Practice

- Discuss:

How do these math practices combined with math content fit or not fit with your own ideas of "mathematical rigor?" How do the math practices enhance the rigor of the content?

Getting Familiar with the Standards for Mathematical Practice

- Few minutes to work on the Staircase Problem.
- Not necessary or expected to finish it – just start it and share 1-2 ideas you have with someone else about how you're thinking about the problem.



Content Standard

7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

Getting Familiar with the Standards for Mathematical Practice

- As you watch the video, keep the following question in mind:

What evidence of MP #3 do you see as the students work on the problem in the video?

Getting Familiar with the Standards for Mathematical Practice

- Having watched the video and identified some possible examples of students' use of MP #3, discuss:

What evidence from the video did you see that you think embodies MP #3?

Getting Familiar with the Standards for Mathematical Practice

- *Based on what you're thinking at this point, what are three things that now seem central to you about "rigorous mathematics?"*

Wrap Up

- Summarize where you ended up today
- Parking lots questions
- Any follow-up steps?

Next Time...

- #1 *Shared Beliefs About Math Instruction for Students with Disabilities*
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- #5 *Responding to a Range of Learning Needs*