<table>
<thead>
<tr>
<th>Session 1: Mathematical Rigor?</th>
<th>Time Allotment</th>
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<tbody>
<tr>
<td></td>
<td>90 minutes</td>
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</table>

**Outcomes(s)**

Participants will:

- Identify the differences between rigorous and non-rigorous mathematical tasks.

<table>
<thead>
<tr>
<th>Slides</th>
<th>Lesson Flow</th>
<th>Research/Helpful Hints For facilitators only (Do not read to participants!)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Slide 1: Welcome everyone to the CCRS Professional Development Meeting for 2016-2017 school year. What rigor looks like in the math classroom will be our focus for this year.</td>
<td>Please do not spend too much time on these slides. Slides 1-2</td>
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</table>
|        | Slide 2: There are 2 outcomes for this session. The outcomes for QM #1 are: Participants will:  
  - Identify the differences between rigorous and non-rigorous mathematical tasks. | |
<table>
<thead>
<tr>
<th>Slide 3:</th>
<th>Note About Fluency:</th>
</tr>
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<tbody>
<tr>
<td><strong>Rigor: Yellow Section</strong></td>
<td>Each standard has to be held up to a lens and the teacher needs to show it in a variety of ways. Students must be able to understand it and put it in their own words. You want all students to be fluent in the language of the mathematics (adding, subtracting, multiplying, dividing, and math vocabulary). Teachers have to make time to teach fluency and not rely on memorization. It has to be taught with strategies. Students should be able to apply a variety of appropriate procedures flexibly.</td>
</tr>
<tr>
<td>This document was introduce in the Math CCRS Quarterly meetings. It explains major shifts for mathematics. This document was used throughout previous CCRS meetings and is still relevant.</td>
<td><strong>Fluency:</strong></td>
</tr>
<tr>
<td>The yellow section discusses rigor or sections 3,4,5, and 6.</td>
<td>Efficient and Flexible</td>
</tr>
<tr>
<td>What are the characteristics of Math Rigor according to this document?</td>
<td><strong>Deep Understanding:</strong></td>
</tr>
<tr>
<td>This document gives us insight into three characteristics of rigor for math. Throughout the presentation these are the 3 Big Ideas for rigor to promote.</td>
<td>Conceptual understanding not just a procedure without meaning.</td>
</tr>
<tr>
<td><strong>Application:</strong></td>
<td><strong>Application:</strong></td>
</tr>
<tr>
<td>Real World Context</td>
<td></td>
</tr>
<tr>
<td>Please do not spend too much time on this slide. (3-5min)</td>
<td>The big ideas and shifts for teaching mathematical rigor is for students to be taught fluency, understanding, and application of the mathematics, not procedural mathematics.</td>
</tr>
</tbody>
</table>
This slide ties back to the definition of Rigor from the morning session.

**Slide 4:**

Have someone read the quote or let the participant read the quote silently. Then ask…

**What is the non-negotiable core for students learning at high rigorous levels?**

Then ask..

What does it mean all students?

What level should all students be taught?

How much growth should you expect every child to have each year in mathematics?

**Another Big Idea:**

**Effective teaching is the non-negotiable core for rigor.**

This quote is from NCTM, National Teachers of Mathematics, book, Principles to Actions, 2014.

*The point to be made is rigor is for all students not just the advanced, accelerated, gifted etc.*

**Slide 5:**

In previous CCRS meetings, math has spent a lot of time discussing what the student should be doing in math class and the Math Practice Standards have been a major part of the focus. These practice standards are for students. We have referred to them as the student’s “habits of mind.” *Click to have the Student Math Practices to fly in.*

**Now our focus will be shifting to what teacher practices or habits are vital to promoting the Math Practice Standards in students.**

**Background Knowledge:**

These standards are characteristics which describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices are based on important “processes and proficiencies” that have longstanding importance in mathematics education. These proficiencies include adaptive reasoning, strategic competence, conceptual understanding, procedural fluency and productive disposition.

From the morning session rigor fosters...

Persistence, resilience flexibility, purposefulness, math cognition and ownership

MPS promote RIGOR

The 8 practices fly in one at a time.

<table>
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<tr>
<th>Slide 6:</th>
<th>Materials Needed:</th>
</tr>
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</table>
Define effective teaching… We know what habits/practices students should have with the 8 Math practice standards, but what practices should teachers have?

What practices should teacher have to support a rigorous curriculum?

Think about what is one non-negotiable practices you feel as a leader every teacher must demonstrate effectively?

Then at your table Brainstorm what effective teaching practices are and settle on your top eight.

**Paper Folding Activity:**

Each group fold a piece of paper into 8 squares.

Then at your table decide what your group feels are the eight effective teaching practices are.

Materials Needed:

A blank piece of paper folded into 8 squares.

1 for each table or group.
### Slide 7:

Next show the eight effective high-leverage instructional teaching practices for mathematics.

Have the groups compare their list to what research for mathematics states are the high leverage teacher practices.

These Eight Mathematics Teaching Practices provide the framework for strengthening the teaching and learning of mathematics. This research-informed framework of teaching and learning represent a core set of high-leverage practices and essential teaching skills necessary to promote deep learning of mathematics. By high-leverage practices NCTM means, “these practices at the heart of the work of teaching are most likely to affect student learning.”

All teachers just as all students should develop their math practices to be an effective teacher and learner of mathematics.

### Slide 8:

What we do know is effective teaching establishes rigor, now let’s think about the classroom environment and assignments.

Guide participants to make the connection, rigor is determined by students and teachers. Rigor is not determined by what we assume is taking place in the classroom.

Every teacher must have these practices in their arsenal is the message we hope to convey.
Can you really tell by looking in a classroom if it is a rigorous environment? It helps to see, but it is also helps with what you hear!

**We cannot tell because the students and the teacher are missing.** The way a classroom is set up does not ensure effective teaching. We assume the classroom with the groups is the best, but do we really know? We must observe the math practice standards for students as well as the math teaching practices for teaching to know if this is a rigorous environment and assignments.

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**Math Teaching Practices (MTP) and Math Practice Standards (MPS) will fly in.**

**Slide 9:**
Have participants to read the slide. Let them discuss briefly in small group their reaction to the definition of rigorous environment and rigorous assignments. Lead a whole group debrief then ask the questions

“Where do the teaching practices apply?”

“Where do the math practice standards apply?”

Click and the answers should fly in.

**Background Knowledge:** Not to be read to participants, but used to help facilitate discussion.

Principles to Action (page 11)
**Productive Beliefs.**

So a rigorous environment and assignments means:

- There is a Focus on developing understanding of concepts and procedures through problem solving, reasoning, and discourse. (MTP)

- All students need to have a range of strategies and approaches from which to choose in solving problems.
Have participants to read the standard at the top of the handout. This is a 4th grade standard. Study the Compare and Order Worksheet on the left side of their handout. Think about what you have learned or know about a rigorous task or assignment, does this task qualify?

(MPS)

- The role of the teacher is to engage students in tasks that promote reasoning and problem solving and facilitate discourse that moves the student toward shared understanding of mathematics. (MTS)

- The role of the student is to be actively involved in making sense of mathematics tasks by using varied strategies and representations, justifying solutions, making connections to prior knowledge or familiar contexts and experiences, and considering the reasoning of others. (MPS)

- An effective teacher provides students with appropriate challenge, encourage perseverance in solving problems, and supports productive struggle in learning mathematics. (MTP)

<table>
<thead>
<tr>
<th>3 Big Ideas for Rigor</th>
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<tr>
<td><strong>Fluency:</strong> Efficient and Flexible</td>
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<tr>
<td><strong>Deep Understanding:</strong> Conceptual understanding not just a procedure without meaning.</td>
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<tr>
<td><strong>Application:</strong> Real World Context</td>
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</table>
Facilitate a discussion….

There should be a consensus that the task does not promote rigor.

Have them to refer back to the MPS and Math Teaching Practices and their handout from the rigor session.

From the morning session rigor fosters…

Persistence, resilience flexibility, purposefulness, math cognition and ownership.

<table>
<thead>
<tr>
<th>Handout 4</th>
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Slide 11:

Now look at the right side of the handout. Go through the same process as the previous slide. The teacher directions would be for students are to work in pairs and they may not use a procedural shortcut or common denominators to solve the problems.

Have participants to reread the standard at the top of the handout. This is a 4th grade standard.

Study the Compare and Order Worksheet on the right side of their handout.

Think about what you have learned or know about a rigorous task or assignment, does this task qualify?

There should be a consensus that

| Major shift in thinking….
It is not more stuff, but deeper thinking.

Look-fors for Rigor….

Does not ask for the < and > sign.

Ask to identify which fraction is larger and why.

Partner work.

Discuss your thinking.

Record your strategies.

Mixture of problems, the problems do not follow one set of rules.

Scaffolding of problems

Multi-entry points
the task does promote rigor. Have them to refer back to the MPS and Math Teaching Practices and their handout from the rigor session.

From the morning session rigor fosters…persistence, resilience flexibility, purposefulness, math cognition and ownership.

Handout 5

Slide 13:
Looking at the evidence for rigor.

Lead a discussion on whether the evidence can prove this was a high leverage assignment/task....

- Was there a focus or learning target for the assignment?
- Was there a focus on developing understanding of concepts and procedures through problem solving and reasoning?
- Did this pair of students have a range of strategies and approaches from which to choose in solving problems?
- Did this assignment engage students in a task that promotes reasoning and problem solving?

Remember...
- The role of the student is to be actively involved in making sense of
mathematics tasks by using varied strategies and representations

- An effective teacher provides students with appropriate challenges, encourages perseverance in solving problems, and supports productive struggle in learning mathematics MTP

Refer back to the big ideas of rigor, fluency, application and deep understanding.

<table>
<thead>
<tr>
<th>Slide 13: Where to next…</th>
<th>Note of Importance:</th>
</tr>
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<tbody>
<tr>
<td>Connecting instruction to authentic real-world applications is a dominant feature in academic rigor. This is an example of going deeper not wider with a standard.</td>
<td>The 4th grade standard limits the comparison of fractions to fractions with the same whole. But in this problem, questions (b) and (c) pushes the students to think not only about the fraction but what is being compared. The fractions in order to be compared must consider the wholes being different. So, questions b and c can only be compared when the whole changes. This concept is explored more deeply in later grades, however the seed is planted early that the whole being compared can change the meaning of a fraction. Question (a) models a real world application for Fourth grade and questions (b) and (c) push the thinking even more, but does not have to be explored specifically in fourth grade. It is an applied concept that comes about naturally in the learning process.</td>
</tr>
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</table>
Connect to 4 Myths reading from Rigor session.

Slide 14:
Reflect about Rigor:
Read these bullets to participants and ask them to consider which are true or false.

Allow participants a few minutes of think time to formulate an opinion or solidify their thinking.

Then lead a whole group discussion — Discuss why they are true or false, and what impact such misconceptions have on rigorous instruction.

Rigor: Requires fluency, application, and deep understanding.

This is an opportunity to summarize the participant’s thoughts.

Rigor is scaffolding student’s thinking. TRUE

Rigor is harder worksheets. FALSE

Rigorous instructional tasks must always have a real-world context. FALSE*

*In ELA rigor always has a context, but not true in math. The worksheet with numbers alone without any text was a rigorous task because it asked for fluency and conceptual understanding. Also Math Practice Standard 2 (MPS 2) states students must have the ability to contextualize and decontextualize. Page 6 AL CCRS

Mathematical reasoning is a component of rigor. TRUE

Rigor is providing higher grade content. FALSE**

**Advanced placement does not constitute rigor.

Slide 15: Next Steps
Ask participants to answer the four questions on an index card. This is for the CCRS SDE Design Team to

The participants need to put their school system on the card.
needs an index card

formally assess where to go next in planning the 2nd CCRS Meeting. Participants will use these information in the debriefing session at the end of the day.

Feedback Questions:
- What is working?
- What is not working?
- What do I want to do to make it work better?
- What support do I still need?

Slide 16:

Resources:
Principle to Action (NCTM)
Rigor and Engagement for Growing Minds
The Ongoing Assessment Project (OGAP)