High Quality Mathematics Discourse in the Early Elementary Grades

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Emphasize a change in which students engage with and communicate about important mathematics content

- **CCSS.Math.Practice.MP3** Construct viable arguments and critique the reasoning of others.

- Demonstrate the importance of productive mathematical conversations
Critical Question

- How do elementary grade teachers promote and support student engagement in high quality mathematics discourse?
Three Components

- **Discourse**: understand what high quality discourse for all is and how it supports conceptual understanding.

- **Instruction**: understand how certain discourse strategies support the design and implementation of lessons that promote high quality discourse for all.

- **Content**: understand the importance of knowing mathematics for teaching for supporting high quality discourse.
Overview of Session

- Introduction to Mathematics Discourse and Discourse Matrix
- Engagement with Discourse Strategies
- Consider implications of the work for your own school/district context
What is high quality mathematics discourse?

- When you think about high quality mathematics discourse, what feature(s) do you consider most important?
- How does high quality mathematics discourse relate to our focus on the Common Core Standards for Mathematical Practice?
Mathematics Discourse Strategy

• ALL TALK
  ◦ Quick strategy that allows each student to share a brief idea
  ◦ Gives everyone a voice
  ◦ Begins with a prompt
Sharing our Ideas about High Quality Mathematics Discourse

ALL TALK

BRIEFLY...

One important feature of high quality mathematics discourse is...
Connecting Literacy and Mathematics

In language arts, it is not enough that students can read the words—they must comprehend the message. Likewise, in mathematics, it is not enough that students can manipulate numbers and symbols and read math words. To be proficient, students must draw connections between these symbols and what they represent. The standard for math should be the same as the standard for reading—bringing meaning to the printed symbols.

– Marilyn Burns
Definition of High Quality Mathematics Discourse

*Patterned* ways of using questioning, explaining, listening and various modes of communication in the classroom to promote conceptual understanding in mathematics.
MATHEMATICS TEACHING GUIDE FOR RESPONSIVE DISCOURSE

PLAN
Identify goal; Select task(s); Understand the mathematics; Consider challenges; Anticipate; Decide how; Determine grouping

LAUNCH
Establish purpose; Engage; Elicit prior knowledge; Introduce language; Model expectations; Scaffold

EXPLORE
Monitor; Promote connections; Scaffold discourse; Select and sequence; Encourage rehearsing

DISCUSS
Assess; Scaffold discourse; Release responsibility; Support understanding; Select extensions; Push for connections; Promote students’ authority; Formalize

REFLECT
Assess; Examine classroom discourse; Evaluate progress; Consider further scaffolding

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# Mathematics Discourse Matrix

*Project AIM, 2012*

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<th>Dimensions of Discourse</th>
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**Dimensions of Discourse**

- Beyond Good Teaching: Advancing mathematics education for ELLs. Ch. 9 (Driscoll, Heck, & Malzahn, 2012)

**Types of Discourse**

- Based on Levels of a Math–Talk Learning Community (Hufferd-Ackles, Fuson, Sherin, 2004)
Types of Discourse

- Correcting – what
- Eliciting – what and how
- Probing – what, how, and why
- Responsive – what, how, why, and connections

(Project AIM, 2012)
Transitions Between Types of Discourse

- Correcting ↔ Eliciting
  - Difference in breadth of what is discussed and by whom

- Eliciting ↔ Probing
  - Difference in depth of the mathematics involved in the conversations

- Probing ↔ Responsive
  - Difference in responsibility

(Project AIM, 2012)
Correcting & Eliciting Discourse

- **Correcting Discourse:**
  - Questions attend to the solution *(what)*
  - Procedural explanations given by teacher
  - “Explanations” focus on answer only; lacks attention to students’ strategies
  - Listening for correct answers; students looking for verification
  - T initiate–S respond–T evaluate pattern of discourse
  - Academic language expected

- **Eliciting Discourse:**
  - Open-ended questions attend to the solution and explanation of strategy *(what and how)*
  - Additional explanation given by teacher
  - Explanations focus on solution and explanation; incorrect answers accepted
  - Listening for student explanation; students looking for approval
  - Turn-taking patterns so more students participate
  - Academic language and everyday language allowed
Probing & Responsive Discourse

Probing Discourse:
- Questions probe for justification and depth in mathematics
- Explanations focus on solution, explanation of strategies, and justification (*what, how, why*)
- Incorrect answers (mistakes) seen as learning opportunities
- Students listening to each other’s explanations
- T–S1–S2–S3 pattern of discourse
- Multiple representations encouraged

Responsive Discourse:
- Questions press for *what, how, why*, and mathematical connections
- Explanations focus on the solution, explanation of strategies, justification, establishing mathematical connections (*what, how, why, making connections*)
- Students listening to compare and contrast their mathematical ideas
- Significant student–student discourse pattern
- Multiple representations used to make mathematical connections
Classroom Discourse

Pattern 1

Pattern 2

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Nathan & Knut, 2003
Begins with the teacher posing a question about the mathematical work students have done, asking students to share mathematical ideas

Each person who speaks must respond to the comment made immediately before them

If someone breaks the chain or the conversation gets off track, the teacher can re-direct the talk chain
SENTENCE FRAMES TO SCAFFOLD THE TALK CHAIN

- You just said that _______. I (agree/disagree) with it because _____________.

- I understand that you ____________ and I want to (add to/change) what you said by saying _______________.
Use the Discourse Matrix.

What type(s) mathematics discourse are typically taking place in your classroom or in classrooms you have observed? Provide evidence in your response.
What Mathematical Knowledge for Teaching is Necessary to Engage in Probing and Responsive Discourse?

- Teachers need to know math differently!
- Work on a math problems for teachers in context of one more discourse strategy.
Mathematics Knowledge for Teaching

- Important uses:
  - choosing tasks
  - posing questions
  - giving and appraising explanations
  - analyzing student work, listening to students’ mathematics ideas
  - mediating a discussion

- Allows teachers to highlight important ideas, push on student thinking in productive ways, and promote meaningful conversations about mathematics.
Adapted from Literacy

Students think through and discuss solutions to a problem and create a well-organized representation of their thinking for sharing

Purpose:

- Organize and prepare to share mathematical thinking
- Make mathematical thinking available to others

Tied to explaining and modes of communication
Directions and expectations for the final sharable product should be clearly communicated to students.

- Materials should be made available.
- Students should have the opportunity to rehearse explaining their answers.
- The selection and sequencing of presentations matter.
Supporting All Students

- Have open-ended sentence frames to help students get started with their presentations
- Provide a word bank with mathematical terms students can use in their presentations
- Allow the use of graphic organizers, diagrams, visual aids for student presentations
- Have students write a sentence with teacher/peer support before presenting in front of the whole class
A class of second grade students was given the problem 92–57 to solve. One student, Maria, turned in the following work on the problem.

Maria’s Work: Start with 92–57. Change 92–57 to 90–55. First, add 5+55=60, then add 60+30=90. So 5+30=35.

1) Describe Maria’s method for solving the given subtraction problem using a number line.

2) Use another representation to explain her method (words, numbers, pictures, etc.).

3) Explain the connections between your two representations of Maria’s method.
How can the use of discourse strategies increase student conceptual understanding in mathematics?

Talk Chain😊

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