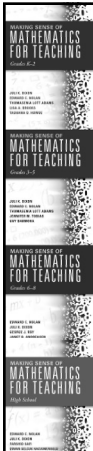


Planning and Reacting: How to Support Teachers to Respond to Student Thinking

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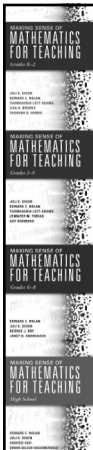
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Session Goals

- Share strategies for helping teachers plan effective questioning.
- Discuss how teachers respond to student thinking.
- Highlight questioning in the TQE Process.

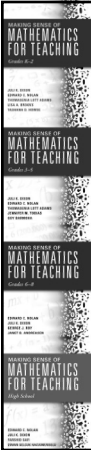
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Questioning

- Why do teachers ask questions?
- What differentiates effective questions from non-effective ones?
- How do we help build the ability to ask good questions?

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Walk-Through

Now, we are going to “walk through” one teacher’s development of questioning...

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from Smith, M. S., Stelle, M. D., & Raith, M. L. (2017). *Taking action: Implementing effective mathematics teaching practices in grades 6-8*. Reston, VA: National Council of Teachers of Mathematics.

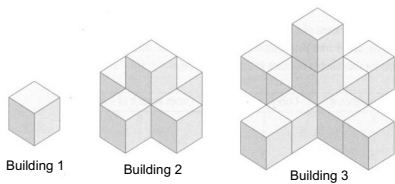
Counting Cubes Task

Building 1 Building 2 Building 3

1. Describe a pattern you see in the cube buildings.
2. Use your pattern to write an expression for the number of cubes in the nth building.

Adapted from “Counting Cubes”, Lappan, Fey, Fitzgerald, Friel, & Phillips (2004). *Connected Mathematics™, Say it with symbols: Algebraic reasoning* [Teacher’s Edition]. Glenview, IL: Pearson Prentice Hall.
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Counting Cubes Task



- Use your expression to find the number of cubes in the 5th building. Check your results by constructing the 5th building and counting the cubes.
- Look for a different pattern in the buildings. Describe the pattern and use it to write a different expression for the number of cubes in the n th building.

Ibid.

Plan with the TQE Process in Mind



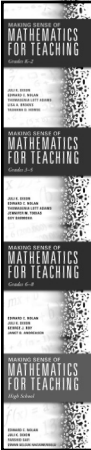
- Select appropriate **T**asks to support identified learning goals.
- Facilitate productive **Q**uestioning to engage students in mathematical practices.
- Collect and use student **E**vidence in the formative assessment process.

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What's the learning goal?

- Create, interpret, and/or use the question, graph, or table of a linear function.
- Model with mathematics.
- Look for and make use of structure.

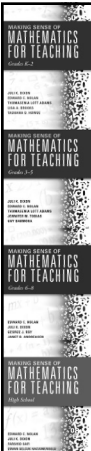
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Solutions to the Task

What solutions do you expect?

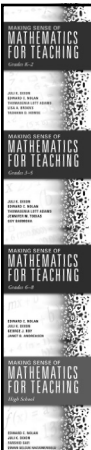
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Solutions to the Task

What questions support student thinking as they determine a solution?

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Making Sense of the TQE Process

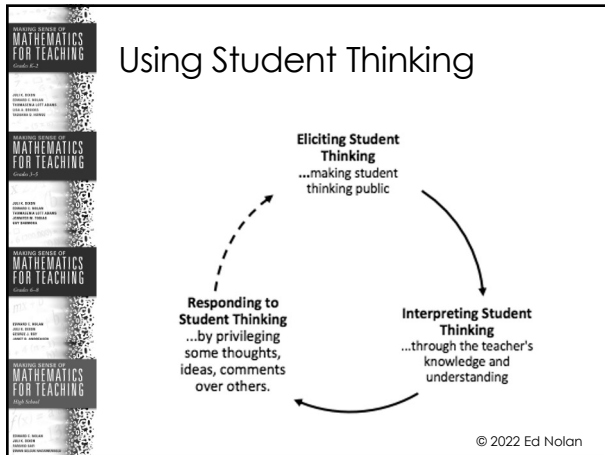


Questions

Teachers who have a deep understanding of the content they teach facilitate targeted and productive questioning strategies because they have a clear sense of how the content progresses within and across grades.

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Possible Student Pathways	Assessing Questions	Advancing Questions								
<p>Has trouble getting started.</p>	<p>What are you trying to find?</p> <p>What do you notice about the buildings?</p> <p>How many cubes are in each of the buildings?</p>	<p>How are the buildings growing? What is changing and what is remaining the same?</p> <p>Use the cubes to build the first four buildings and discuss what you need to do to build each of them. Try to explain how the buildings grow. I'll be back to hear what you come up with.</p>								
<p>Creates a table. Determines the number of cubes in the first three buildings (1, 6, 11) and identifies the recursive pattern "add 5", but does not see a pattern based on the building number.</p> <table border="1"> <thead> <tr> <th>Building #</th> <th># of Cubes</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>6</td> </tr> <tr> <td>3</td> <td>11</td> </tr> </tbody> </table>	Building #	# of Cubes	1	1	2	6	3	11	<p>How did you get the values in your table?</p> <p>Explain the pattern that you found in your table.</p>	<p>You said that the pattern is "add 5". How could you figure out the number of cubes in the 5th building if you didn't know the number of the cubes in the 4th building? Can you see a relationship between a building number and the number of cubes?</p>
Building #	# of Cubes									
1	1									
2	6									
3	11									

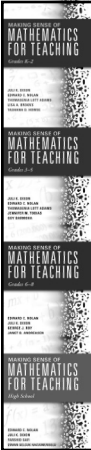


Funneling and Focusing Questioning Structures

When teachers use questioning to lead students to a solution and give less attention to student responses that differ from that line, they are using funneling questioning structures.

Students have less opportunity to make their own connections or build their own understanding.

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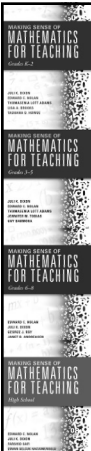


Funneling and Focusing Questioning Structures

When teachers honor student thinking and contributions by asking students to clarify their thinking and the thinking of others, teachers are using focusing questioning structures.

Students have the space to share ideas and build their own understanding rather than the teacher directing the classroom discourse in a particular direction.

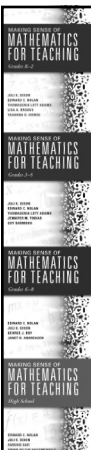
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Planning a Lesson

Where do you think you are with your questioning?

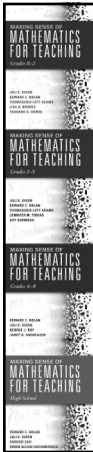
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Planning a Lesson

What do you do to try to get more responses from your students?

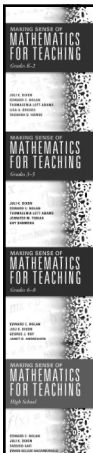
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Planning a Lesson

Do you feel like your kids are really just looking for the steps to follow?

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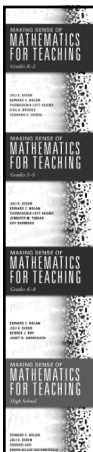


Planning a New Lesson

What's the learning goal?

Students will extend knowledge of adding and subtracting fractions to build understanding of strategies for adding and subtracting rational expressions.

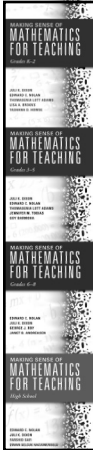
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Teaching and Observing

- How do teacher questions define the classroom environment?
- How do planned questions impact the questions asked while teaching?

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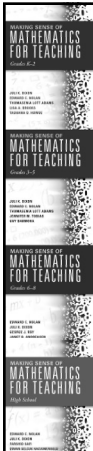


Plan with the TQE Process in Mind



- **Tasks** connect to learning goals and help identify student errors.
- **Questions** elicit mathematical understandings and common errors.
- **Evidence** drives scaffolding and guides extensions.

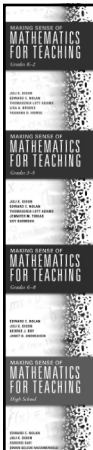
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Funneling and Focusing Question Structures

- When teachers use their own thinking to guide students to solution, they are using funneling questioning structures.
- When student thinking guides the lesson, teachers are using focusing questioning structures.

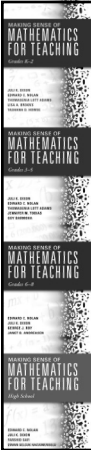
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Supporting Successful Pre-Service Teachers

Ambitious teaching (Lampert et al., 2013) requires teachers to not only use the preconceived ideas developed in their lesson plans but also to incorporate in-the-moment decisions to integrate the focus both on the learning goal and the thinking of the students.

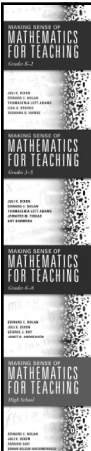
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Supporting Successful Teachers

- How do we prepare teachers for ambitious teaching?
- How do we support the planning and implementation of ambitious teaching?
- How do we help teachers to improve their delivery of ambitious teaching?

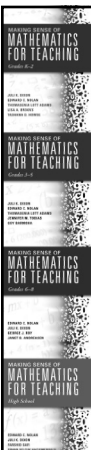
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Focusing on Student Thinking

1. Plan multiple question-and response pathways
2. Ask open-ended questions
3. Listen actively to student answers
4. Act to privilege student thinking
5. Reflect on how the lesson engages students

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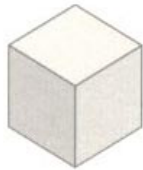


Session Goals

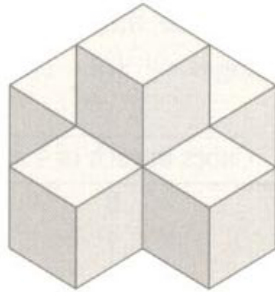
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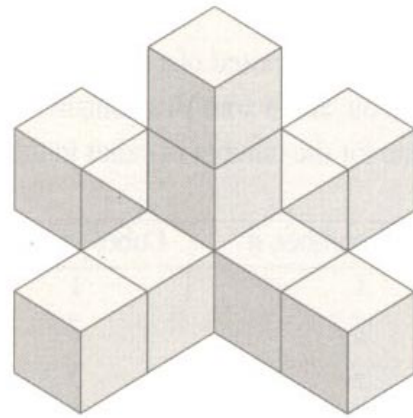
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Building 2



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